RESTRICTED

FM 4–101

WAR DEPARTMENT

ANTIAIRCRAFT ARTILLERY FIELD MANUAL

EMPLOYMENT OF ANTIAIRCRAFT ARTILLERY WITH ARMORED FORCES

March 29, 1943

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(For explanation of symbols see FM 21–6.)

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ANTIAIRCRAFT ARTILLERY FIELD MANUAL

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CHAPTER 1

GENERAL

■ 1. MISSION.—*a.* The normal mission of the antiaircraft (AA) automatic weapons battalion with armored forces is the protection of installations, trains, assembly areas, defiles, and other vital points from low-level and dive bombardment attack.

b. The contingent mission is antitank defense. *This mission should not be permitted to interfere with the normal mission of AA defense unless ordered to assume a primary antitank mission.*

■ 2. CHARACTERISTICS OF ARMAMENT.—*a.* The self-propelled AA gun mount is armed with a 37-mm (or 40-mm) automatic cannon and two caliber .50 AA machine guns. The three guns are mounted as a unit on a half-track (or full-track) vehicle. They are traversed and elevated manually by lateral and vertical trackers. The 37-mm gun can be fired in short bursts at the rate of 120 rounds per minute. Each caliber .50 machine gun can be fired in short bursts at a rate of approximately 600 rounds per minute. (See FM 4–140, 4–135, and 4–159 (when printed).)

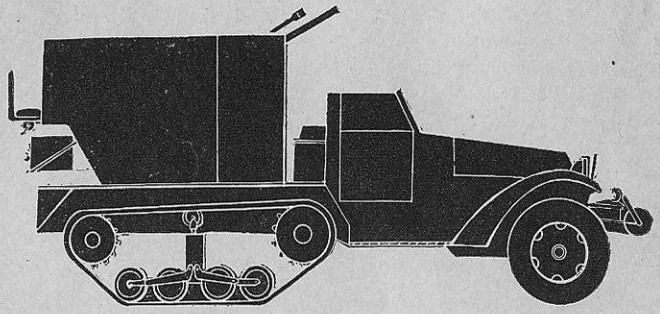
b. The self-propelled AA machine-gun mount is armed with two (or four) caliber .50 AA machine guns, turret mounted on a half-track (or full-track) vehicle. The turret is electrically operated in both azimuth and elevation by a single tracker. (See FM 4–157 (when printed) and 4–135.) The maximum effective slant range is 600 yards.

c. The automatic cannon fires two types of ammunition: high explosive shell (HE) for use against aircraft and armor-piercing shot (AP) for use against armored vehicles. Both projectiles have a tracer element in the base for fire-control purposes. The high-explosive shell is equipped with a super-

sensitive fuze which explodes upon contact. The shell will also explode at the burn-out point of the tracer. The armor-piercing shot is solid.

d. The caliber .50 machine gun fires a nonexplosive bullet.

■ 3. ORGANIZATION.—*a.* The AA automatic weapons battalion (self-propelled) consists of a battalion headquarters and headquarters battery, and four automatic weapons batteries (see T/O 44–75).



1 sergeant, section leader.
1 corporal, AA gunner and squad leader.
4 cannoneers.
1 driver.
1 corporal, squad leader.
1 gunner, AA.
4 cannoneers.
1 driver.

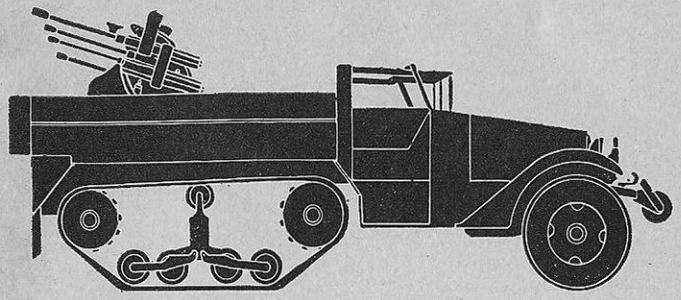
FIGURE 1.—Automatic weapons section, self-propelled.

b. Each automatic weapons battery consists of a battery headquarters, an automatic weapons platoon, and a machine-gun platoon.

c. The automatic weapons platoon consists of a platoon headquarters (which includes an ammunition section) and four automatic weapons sections of two squads each. Each automatic weapons squad is mounted in one self-propelled automatic weapons mount.

d. The machine-gun platoon consists of a platoon headquarters (which includes an ammunition section) and four machine-gun sections of two squads each. Each machine-gun squad is mounted in one self-propelled machine gun mount.

e. The following is a key to symbols in illustrations in this manual:



1 sergeant, section leader.
1 corporal, gunner, MG, and squad leader.
2 cannoneers.
1 driver.
1 corporal, squad leader.
1 gunner, MG.
2 cannoneers.
1 driver.

FIGURE 2.—Machine-gun section, self-propelled.

AA automatic weapons squad, self-propelled.

AA machine-gun squad, self-propelled.

AA automatic weapons section, self-propelled.

AA automatic weapons platoon, self-propelled.

AA machine-gun platoon, self-propelled.

AA battery, self-propelled.

■ 4. TYPES OF AERIAL ATTACK (for a full discussion of aerial targets, see FM 4–105).—*a.* Air attacks, in general, can be classified into five groups:

(1) High-level bombing.
(2) Low-level bombing.
(3) High-dive bombing.
(4) Low-flying attack which includes low-dive bombing, strafing attack, and chemical spray attack.
(5) Airborne attack.

In addition, the reconnaissance airplane can be classified as an aerial target.

b. The high-level bomber and the high-flying reconnaissance aircraft cannot be engaged by the weapons of the battalion. The installations of the armored division are not a normal target for high-level bombing. Protection against the reconnaissance airplane is proper concealment and camouflage.

c. The normal aerial targets for the self-propelled AA automatic weapons battalion are—

(1) Low-level bombers.
(2) Dive bombers.
(3) Low-flying attack airplanes, including bombing, strafing, and chemical spray, at 25 to 400 feet altitude.
(4) Airborne attack.

■ 5. DUTIES OF ANTIAIRCRAFT BATTALION COMMANDER.—The AA battalion commander in addition to his duties as a troop commander is an AA officer on the staff of the division commander to which his unit is attached. (See FM 101–5.) He—

a. Advises the command and staff on all AA matters, including passive defense measures.

b. Determines requirements for AAA ammunition.

c. In cooperation with G–3, G–3 air, and the air officer, plans for all means of active defense against air operations.

d. Recommends missions for AAA.

e. Establishes his command post near the command post of the unit to which he is attached.

f. Maintains a liaison agent at command post of the unit to which attached.

g. Maintains close contact with G–3 for plans of the commander; G–2 for enemy situation and terrain not under our control; G–4 for supply, maintenance, and evacuation; and the engineer officer for special camouflage measures.

h. Recommends requests for additional AAA units as the situation indicates.

■ 6. ALLOTMENT.—*a.* The number of AA weapons in the self-propelled AA battalion is not sufficient to protect all installations of an armored division. The AA battalion commander, after an analysis of the situation, recommends a distribution of AA elements to give the maximum protection in vital areas *based upon priorities established by the division commander.* In recommending a distribution for AAA units, consideration must be given to the organic AA weapons available within the armored units—

(1) Armored division and unit trains have some truck mounted caliber .50 machine guns, but need additional AA protection in bivouac and for a daylight march.
(2) Armored infantry and engineers have only caliber .30 weapons and a few caliber .50 machine guns. They need AA protection on the march, in bivouac or assembly area, during attack and defense.
(3) Armored field artillery has caliber .50 machine guns, but may need some AA protection when supporting an attack.
(4) Tank units have many organic AA weapons, are least vulnerable to air attack, and will seldom need additional protection.

b. In estimating the AA needs, the following questions should be answered (this list is by no means complete):

(1) How many defiles along the route of advance are there to protect and what strength is needed for the protection of each?
(2) Is movement by night or by day? If by night, what protection will be needed after units go into bivouacs or assembly areas?
(3) What is the disposition of armored units in the formation and what is the plan for their use?
(4) What concealment is available in proposed bivouacs or assembly areas?
(5) Are unit or division trains to move by daylight?
(6) Is higher headquarters furnishing protection for railheads and truckheads?
(7) What is known of the enemy air strength? How does he operate? Dive bomb, low-level, or high-level bombing?

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Does he strafe before or after bombing? Are airborne operations anticipated?

(8) What is the commander's plan for the use of available fighter protection? (Coordinate with G–3 air.)

(9) What is the present strength of the AA battalion?

(10) Can more AA units be obtained from corps or army?

(11) *Where can hostile air attack interfere most effectively with our operation?*

c. The characteristics of the weapons of the AA battalion must be considered in determining their distribution. (See par. 2.) The following is a guide:

(1) 37- or 40-mm squads are best employed (not in order of priority):

(*a*) For protection of railheads.
(*b*) For protection of bridges and defiles.
(*c*) For protection of division artillery.
(*d*) For antitank defense.
(*e*) Against low-level bombing, 400 to 2,000 feet altitude.
(*f*) For dive bombing defense.
(*g*) For defense of road blocks.

(2) Machine-gun squads are best employed (not in order of priority):

(*a*) Against strafing attack.
(*b*) For protection of columns.
(*c*) Against extremely low-level attack, 25 to 400 feet altitude.
(*d*) For support of infantry and engineers.
(*e*) Against airborne troops.

d. The AA battalion will rarely be disposed as a unit. It will ordinarily be necessary to distribute batteries throughout the zone of action, to afford protection to vital areas and units. The criterion is to give adequate protection to the most vital points or units, then consider protection for the points or units which have lower priority. ANY ATTEMPT TO DISTRIBUTE THE INDIVIDUAL FIRE UNITS OF THE BATTALION THROUGHOUT THE ENTIRE ZONE OF ACTION IS FATAL; it results in unwarranted dispersal and consequently no element receives adequate protection. A normal distribution would be one battery to each combat command, two batteries less a platoon to the trains, and a

platoon to the division reserve. However, this disposition must not be considered as fixed.

e. Battery commanders, after making their own estimate of AA needs, make recommendations to the commander of the unit to which they are attached, or which they are supporting. These recommendations are based upon answers to questions in *b* above. In making distribution, the battery should not be split into units smaller than the half platoon.

■ 7. CONTROL.—*a.* When units of the AA battalion are widely dispersed throughout the armored division zone of action, such dispersal makes control by the battalion commander difficult. The decision whether to attach batteries to trains or combat commands, or to have the batteries support such units under the AA battalion commander's control, is a command decision which must be based on the situation. RETAIN BATTERIES UNDER THE AA BATTALION COMMANDER'S CONTROL WHENEVER POSSIBLE. It is particularly necessary that batteries be retained under control of the battalion commander in protection of defiles, or if the unit is to remain in position after the combat command leaves.

b. Control is maintained by giving definite, clear orders as to mission, time, place, and route. If a unit is to go into position to protect a defile, assembly area, or bivouac, give time to occupy position, place, time of relief, and where to report upon relief, if known. Radio or messenger is used for transmitting orders.

■ 8. COMMUNICATION.—Communication within the battalion is by radio, messenger, or word of mouth. Liaison airplanes from the armored division headquarters may at times be used for delivery of messages to isolated units.

a. Radio.—The AA battalion is equipped with armored force radio sets. The battalion commander and each firing battery commander has an SCR–506, medium power radio for communication within the battalion and with the unit to which attached. In addition, the battalion commander and commanders down to and including each weapons squad have FM sets for communication within the battalion or with the supported unit. It is the responsibility of the division signal

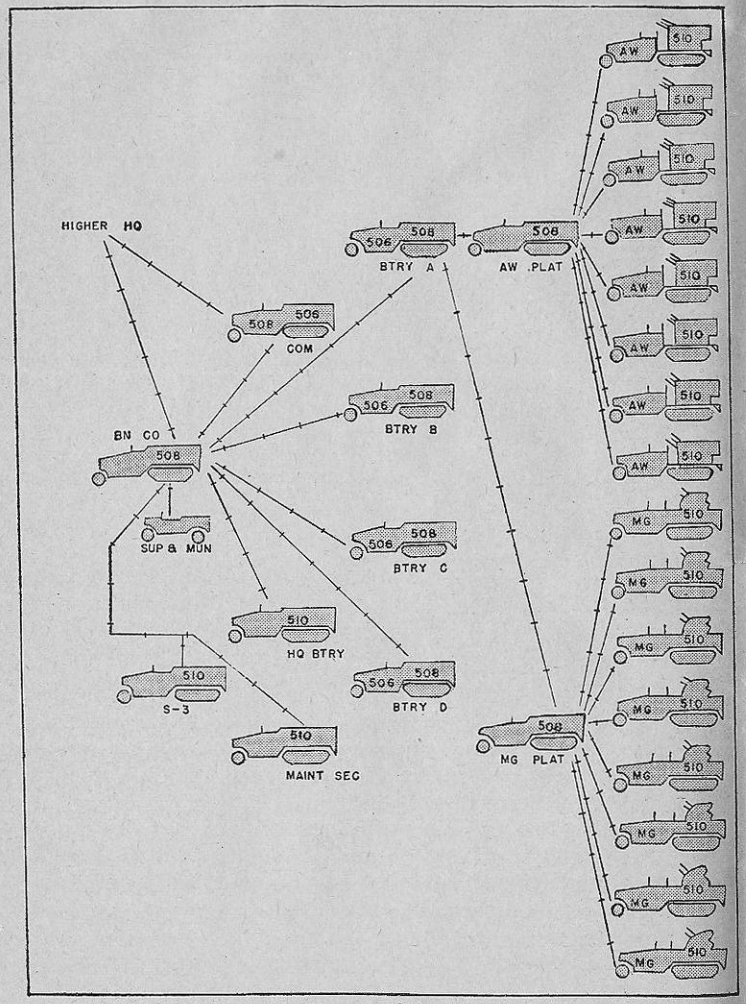

FIGURE 3.—Radio channels of communication.

officer to procure proper crystals for channels allotted. Figure 3 shows radio net. Messages may also be relayed through higher unit channels. On the march, radio receivers of all weapons squads are kept on the air warning or higher unit net.

b. Messenger.—For messenger service the battalion has a few ¼-ton trucks. Messenger service of units of the armored division may also be utilized.

■ 9. INTELLIGENCE.—*a. Battalion intelligence officer.*—(1) Prior to operation, the battalion S–2 procures from G–2, the engineer officer, G–3, the division air officer, other AA units, and other available sources, information concerning—

(*a*) *Enemy air activity.*
- Estimated number of airplanes.
- Type of airplanes.
- Methods of attack.
- Any new weapons used.
- Known location of enemy airdromes or emergency landing fields.
- Airborne troops.

(*b*) *Enemy armored units.*
- Type, number, characteristics, method of operation.

(*c*) Terrain.
- Cover available in area of operation.
- Character of terrain—wooded, bare, rolling, level, mountainous.
- Location and extent of defiles.
- Character of terrain adjacent to defiles as it affects antiaircraft firing positions.
- Location, strength, type, and length of bridges.
- Terrain adjacent to bridges as for defiles above.
- Terrain suitable for mechanized attack.

He sends all pertinent information to the battery commanders who in turn disseminates it to platoons and sections as necessary.

(2) During combat the battalion S–2 keeps in constant touch with G–2. He procures and immediately sends to the interested units any new enemy information that may affect their operation and any additional terrain information. This information may have to be sent over command

channels. Battery commanders must keep in constant touch with the headquarters of the supported unit so that they may immediately obtain any information available at that headquarters. He must immediately send pertinent information to subordinate units.

b. Flash messages.—The transmission of flash messages for aircraft warning is covered in FM 4–105.

c. Battery and lower unit commanders depend on the battalion intelligence officer and the unit which they are supporting for enemy information. Each unit must establish close liaison with supported units and with troops in the immediate vicinity.

d. Periodic reports.—Units submit through command channels periodic reports as called for. See figure 4 for form for report.

■ 10. LIAISON.—The battalion commander sends a liaison officer to the division command post. Each battery commander maintains a liaison agent at the command post of the supported unit. For duties of liaison officers see FM 101–5.

■ 11. ORDERS.—For form for orders see FM 101–5. Orders are usually oral but should, if practicable, be supplemented by marked map, overlay, sketch, or aerial photograph. Orders must be brief but clear. The sacrifice of clearness for brevity should not be tolerated. *Give definite missions.*

■ 12. AIR WARNING.—*a.* For air warning nets see FM 17–100 (when printed).

b. On the march and in bivouac, each squad keeps its receiver tuned to the air warning net or such command net as will insure prompt receipt of air warning. When in position to protect a defile, railhead, or other installation, receivers are kept tuned to the battery or platoon net.

c. At all times a member of the gun crew must be on constant watch for hostile aircraft. Air warning signals are arranged with adjacent troops.

■ 13. LOCAL SECURITY.—*a.* AAA weapons can be used for either ground or AA firing. In general, the AAA units must provide their own local security. *When elements of the battalion are detailed to protect bridges, defiles, or like in-*

Date

PLATOON FROM (hours) _____

BATTERY TO (hours) _____

Time of attack	Numbers of airplanes	Type of attack (high-level bombing, low-level bombing, dive, strafing, gas spray, reconnaissance)	Rounds fired		Airplanes destroyed
			37-mm	Cal. 50	

FIGURE 4.—Periodic report.

stallations, the commander ordering such mission should provide other troops to strengthen the installation.

b. Slit trenches are dug in bivouac, when in firing position, and at long halts during the march.

■ 14. MAINTENANCE.—*a.* The automatic weapons battalion is equipped to perform second echelon maintenance on its own vehicles and has mechanics for minor repair of weapons. The headquarters battery has a maintenance section which performs the bulk of the second echelon maintenance for the battalion. It is not equipped to be split into sections to support each battery during operations.

b. The maintenance officer of the battalion headquarters battery supervises the work of his maintenance section. His duties are similar to those prescribed in FM 101–5 for the automotive officer. He supervises second echelon maintenance within the battalion, makes technical inspection of equipment and such command inspections as the battalion commander may prescribe, and procures maintenance supplies. The maintenance officer contacts the division maintenance battalion for arrangements for maintenance which he is unable to perform because of limitations of time or lack of trained personnel or tools. (See FM 17–58.)

c. The maintenance section of each firing battery is not sufficient to maintain equipment if the battalion is widely scattered during active operations. In such cases, maintenance personnel of units of the armored division located nearby assist in maintenance of AAA vehicles. The division maintenance battalion takes care of maintenance needs above second echelon.

■ 15. SUPPLY.—*a.* The AA battalion is self-sufficient for ordinary supply needs. It carries sufficient fuel and oil in the vehicles and on trucks for 200 miles of operation. Each battery has an ammunition train and also sufficient ration trucks for resupply.

b. For extended operations at some distance from supply points the battalion should be reinforced with additional trucks for fuel and oil and for ammunition.

c. The supply officer of the battalion obtains his supplies through the division to which his battalion is attached. (See FM 17–57.)

■ 16. EVACUATION.—*a.* The battalion has a small medical detachment which during active operations is apportioned to the batteries.

b. The divisional medical battalion is responsible for evacuation of personnel.

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CHAPTER 2

TRAINING

■ 17. GENERAL.—*a.* The nature of the employment of the self-propelled automatic weapons AA battalion requires a high standard of individual and crew training. Gun crews will often be 600 or more yards from adjacent crews. A platoon may cover a line or a bivouac perimeter as much as 5 miles in length. On the march, squads will be located throughout the length of the armored column. Obviously the platoon leader will be unable to exercise close supervision over such squads. In most cases, the section and squad leaders must act upon their own initiative without orders from higher authority. It is therefore imperative that particular emphasis be placed upon thorough individual and crew training. *Each individual must not only be an expert in his own job, but must also have a working knowledge of jobs of other members of the crew.*

b. In selecting men for specialized training, CAREFUL STUDY MUST BE MADE OF THE SOLDIER'S QUALIFICATION CARD (W. D., A. G. O. Form No. 20), of battalion and battery progress charts, and of their general attainments. Quotas of students to technical schools should be filled by the best men available. It often appears that the filling of these various quotas may prove a hardship in the conduct of training, but in the long run the organization will profit materially. Furthermore, there are some types of specialists which cannot be successfully trained within the battalion.

c. Individual training is conducted according to current mobilization training programs. Crew training is conducted as prescribed in pertinent manuals on service of the piece. Some of the subjects that must be particularly stressed are—

Map and aerial photograph reading (FM 21–25, and 21–26).
Vehicle driving (TM 10–460, 9–710, 21–300, and FM 17–5).
Crew drill (FM 4–157 and 4–159).

Antiaircraft gunnery (FM 4–112).
Antitank gunnery (FM 4–112).
Identification of aircraft (FM 30–30, 30–31, 30–34, 30–35, 30–38, and 30–39).
Identification of armored vehicles (FM 30–40, 30–41, and 30–42).
Voice radio procedure and operation of the voice radio (TM 11–454).
Elementary navigation (FM 21–45).
Selection and occupation of position (FM 4–105).
Camouflage and camouflage discipline (FM 5–20).

d. After completion of the crew training, section and platoon tactical problems should be held for various assumed operations. As soon as practicable small units—squad, section, or platoon—should operate with various armored units to familiarize armored and AA units with each other's functions and methods of operation and to develop teamwork.

e. As training progresses, batteries should operate with units of the armored division. For certain problems, they may be attached to units. Training is culminated by the operation of the entire battalion under divisional control in maneuvers.

f. During the period of small unit training the battalion commander and his staff, in addition to supervising training, hold various command post exercises. These must not be so frequent as to interfere with the training of lower units. The battalion commander, the battalion staff, battery commanders, and platoon commanders should participate in command post exercises held by division or combat commands.

■ 18. ANTIAIRCRAFT GUNNERY.—The maximum time available should be devoted to training in AA gunnery. In order to hit the present high-speed airplane, the initial lead must be as accurate as possible. In early stages of training, this means a study of leads and lead characteristics (see FM 4–112). Training in firing at balloons (if available) will furnish the "feel" of the weapon and will provide some training in adjustment of the tracer stream on to the target. Rocket targets provide excellent training in engaging high-speed and dive bombing targets. Later, as much firing as possible should be conducted against high-speed targets with emphasis on—

a. Smooth tracking.

b. Accuracy of the initial leads.

c. Adjustment of the tracer stream on to the target.

Every member of the squad should be able to perform the duties of at least two key positions. (See par. 17*a*.) All members should have a thorough knowledge of leads and lead characteristics.

■ 19. TRAINING PROCEDURE, TACTICAL EXERCISES.—*a. The only purpose of training is preparation for battle.* Tactical exercises are the dress rehearsal. However, the actors in a tactical exercise do not read from a previously prepared script or perform a certain previously designated act. Each tactical exercise and each combat situation presents a new problem that cannot be solved by a fixed set of rules. The fundamentals learned in training are applied to the particular situation at hand. Individual initiative must be encouraged and must not be stifled by stereotyped solutions.

b. For training in combat situations, selection of positions and conduct of AA defense, use should be made of the sand table. Blocks of wood may be used to represent vehicles. Each problem should be run several times until all noncommissioned officers have had an opportunity to present solutions. (See TF 7–265 and 7–266.)

c. (1) First determine the particular tactical operation to be covered—marches, defense of a bridge, train defense, or others. Examine the map and select a suitable piece of terrain that will bring out the desired lessons. Then—

(*a*) Find out if the terrain is available on the date required.

(*b*) Make a personal reconnaissance of the terrain.

(*c*) Construct a replica of the terrain on the sand table.

(*d*) Draw up a situation that will bring out the desired lessons.

(*e*) With other officers of the battalion or the battery, play the problem.

(*f*) Next with noncommissioned officers and selected privates present, replay the problem. The whole gun squad should be present in some cases.

(*g*) Require noncommissioned officers to give solutions to problems and to give their orders.

(*h*) Keep up interest by injecting small situations, such as—

1. Two hostile tanks attack the squad position.
2. A platoon of parachute troops is dropped near a bridge being protected by the gun squad.
3. On a road march an air attack is received or hostile tanks attack.

(2) Next play the problem on the terrain. Check technique of march, selection, occupation, and camouflage of positions. Arrange to have airplanes and tanks attack the position.

(3) Hold a critique. Point out errors and one or more possible correct solutions. *Make critiques instructive. Do not under any circumstances ridicule any individual's solution.* If the individual shows evidence of improper attitude, it should be the subject of disciplinary action but such disciplinary action is not proper at a critique.

■ 20. DRIVING.—*a.* Instruction in driving and in the care, maintenance, and inspection of vehicles is covered in various Technical Manuals and Training Films. See FM 21–6 and 21–7. Driving as covered herein pertains to the use of terrain in combat in moving or concealing vehicles. Each member of the crew must be trained to choose routes that will give the vehicle maximum cover and that at the same time can be easily traversed.

b. The following should be answered:

What is the nature of the soil? Is it hard or soft? Will the vehicle sink in a short distance and then be able to move forward, or will it break through a crust and then bog?

Is the ground level or rolling?

Is the surface eroded, forming barriers around which a route must be reconnoitered?

Are stream banks soft and swampy, or hard? Steep or sloping? Can vehicle climb the stream bank?

Are stream bottoms hard sand or gravel, or are they soft mud? How deep is the water?

What is the type of vegetation? Does it offer concealment from air and ground observation? Can firing positions be found?

Is forest heavy or light?

Is ground smooth or is it covered with numerous large boulders or stumps?

c. Only by practice can individuals tell what ground can be traversed and what is impassable. Route reconnaissance must be thoroughly taught.

■ 21. SELECTION AND OCCUPATION OF FIRING POSITIONS.—*a.* The selection of good AA firing positions is directly opposed to concealment from the air. A good position should—

Permit a wide sector of fire. All around fire is desirable.

Allow guns to fire from lowest elevation.

Afford good natural cover.

Afford maximum camouflage possibilities consistent with AA firing missions.

Be suitable for antitank positions.

Be situated to take advantage of ground protection afforded by other troops.

Be fairly level to provide proper tracking.

b. Select alternate positions for both AA and antitank defense.

c. Squads operate normally in sections so that they can supplement each other's field of fire and so all around fire can be obtained.

d. In going into position, use covered routes. Brush out tracks. They will disclose your position.

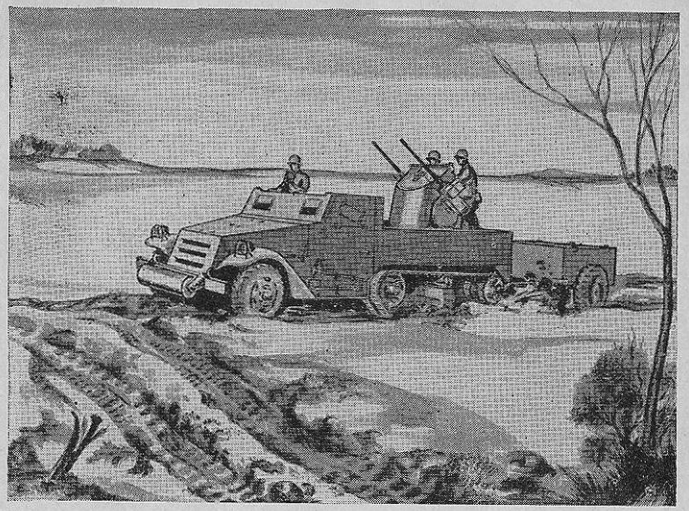

FIGURE 5.—Ground soft. Vehicle sinks in only short distance and is able to proceed in low gear.

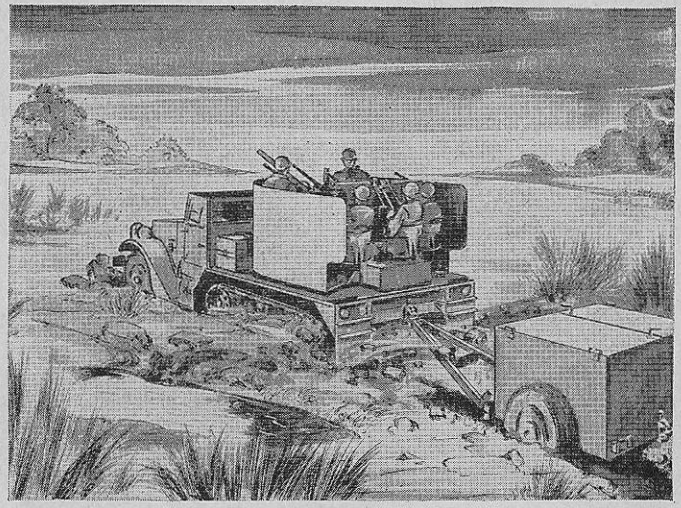

FIGURE 6.—Crust has broken and vehicle has bogged.

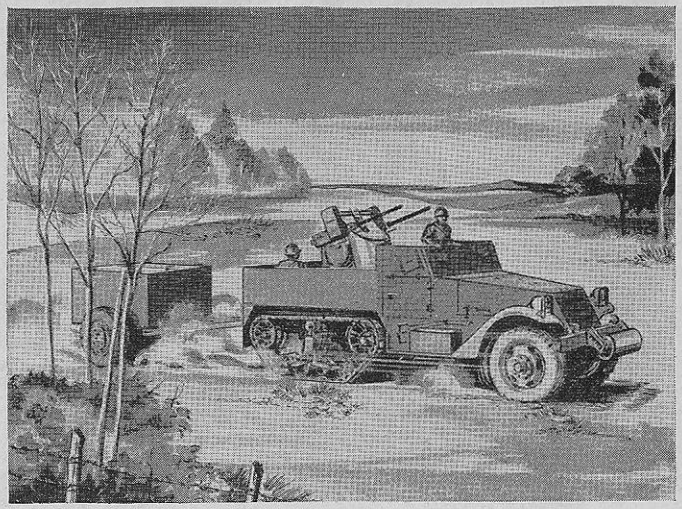

FIGURE 7.—Surface is hard, going is good.

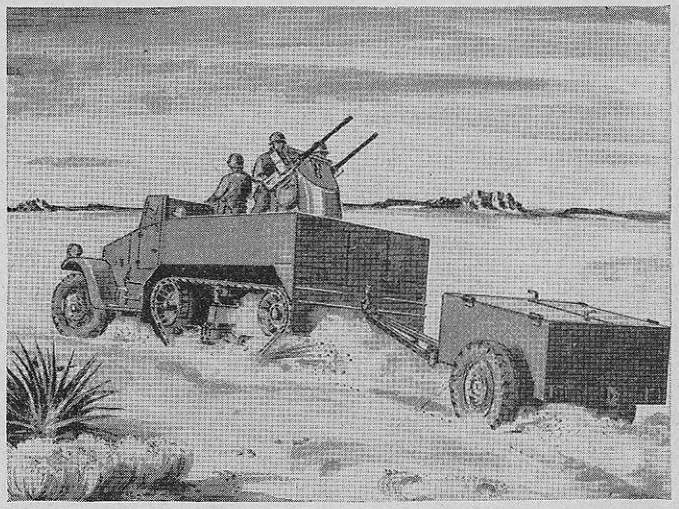

FIGURE 8.—Soil sandy. Passable but increases fuel consumption.

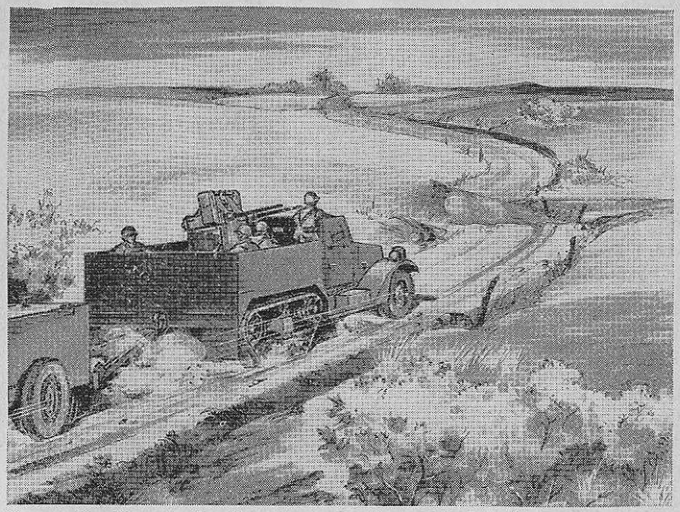

FIGURE 9.—Terrain level and open. Camouflage is difficult. Firing positions excellent for view.

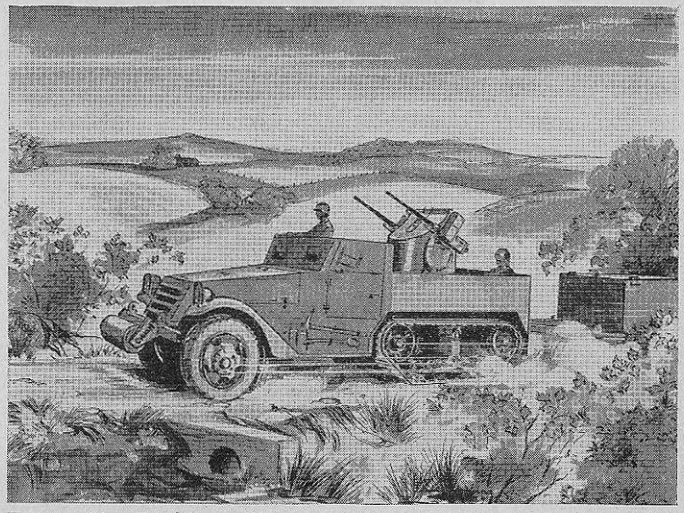

FIGURE 10.—Terrain rolling. Offers good natural cover. Firing positions must be carefully selected to prevent masking by low hills. If soil is hard, watch for erosion.

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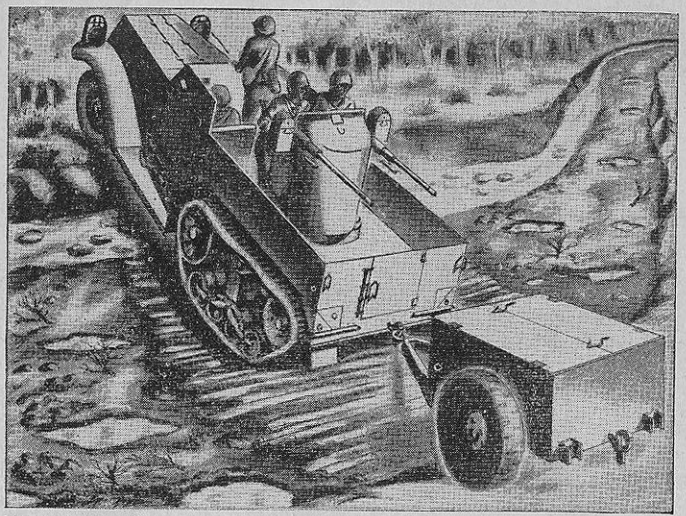

FIGURE 11.—Streams. Swampy banks will require hasty corduroy. Sandy and hard banks can be crossed easily if not too steep. Precipitous banks require cutting down or bridging.

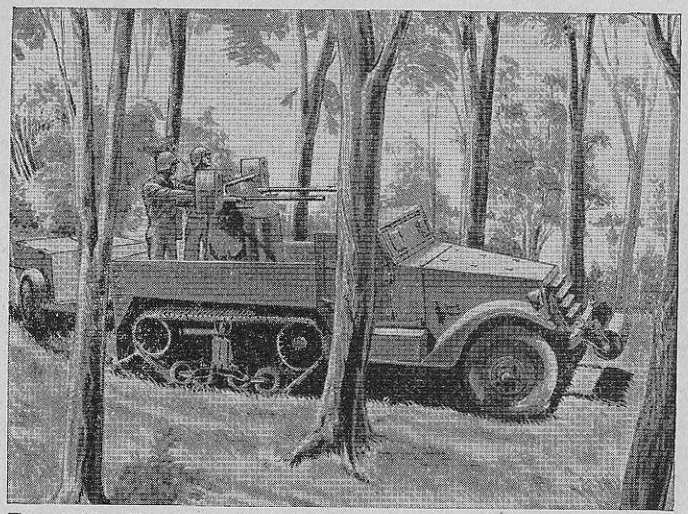

FIGURE 12.—Heavy forests require careful reconnaissance. AA positions cannot be obtained and antitank positions are poor. Concealment is good.

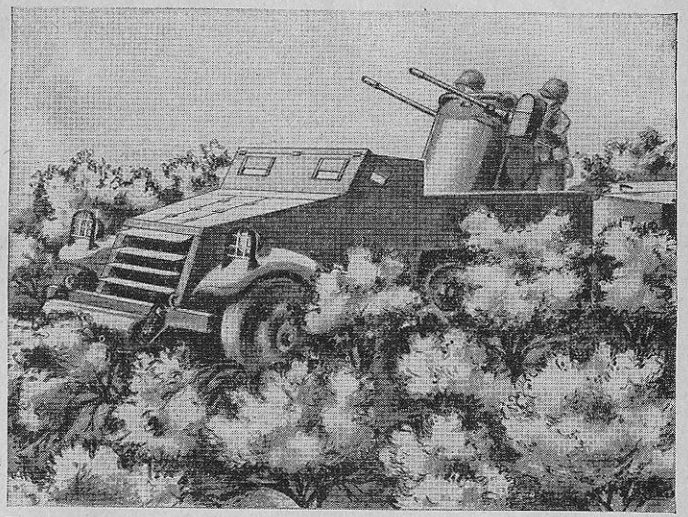

FIGURE 13.—Light brush is easy to traverse. Beware of deep holes. Offers good concealment from ground but poor concealment from air observation.

FIGURE 14.—Ground covered with large rocks and stumps is difficult to traverse.

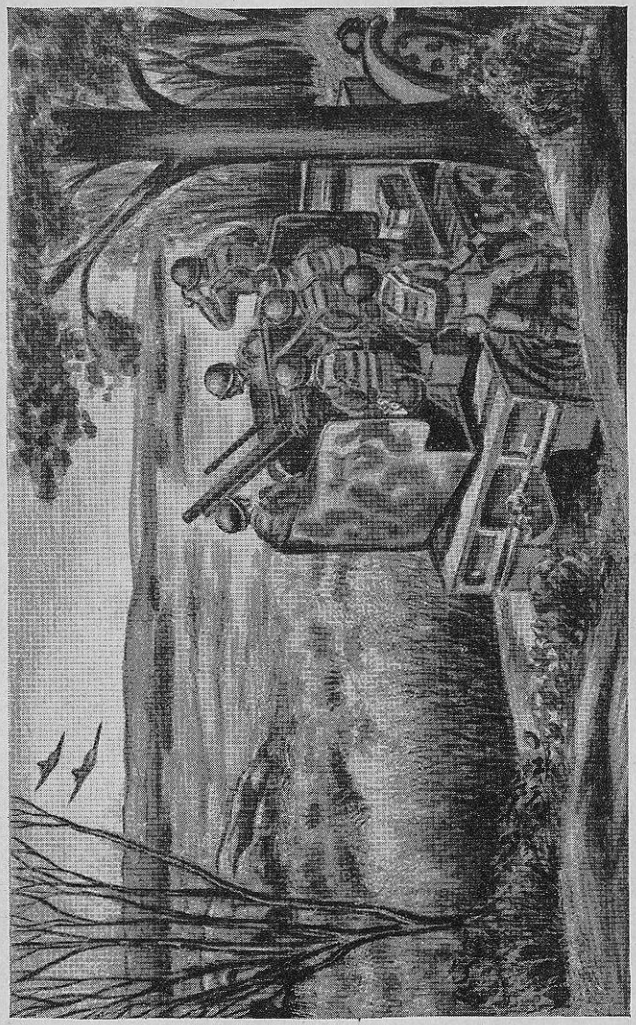

FIGURE 15.—Do not occupy a position in woods if more open position is available. Positions in corner of woods, preferably on high ground, may be used.

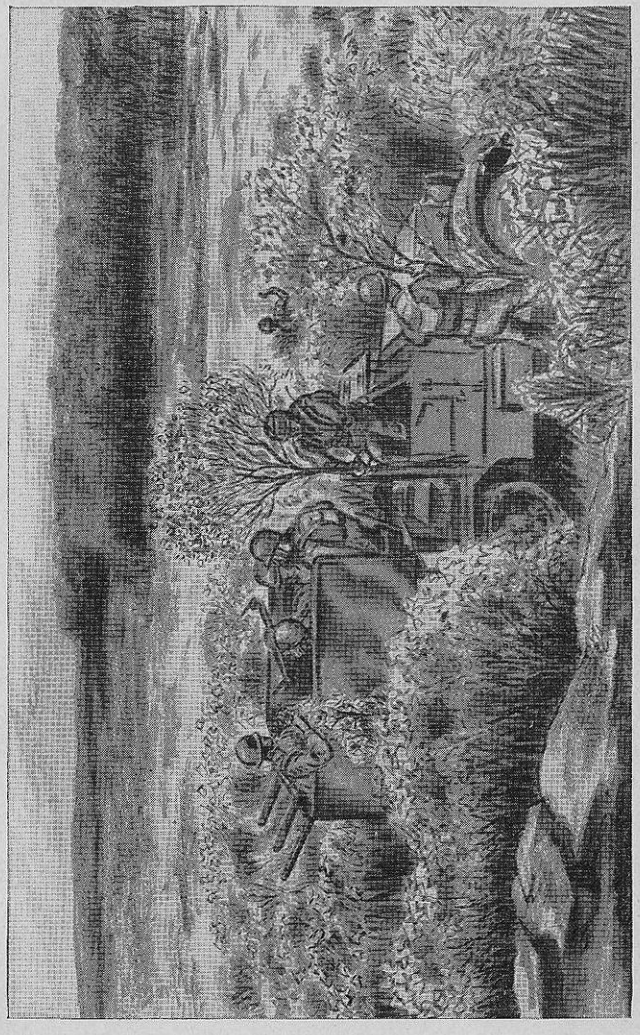

FIGURE 16.—Place mount in brush in open if it can be camouflaged.

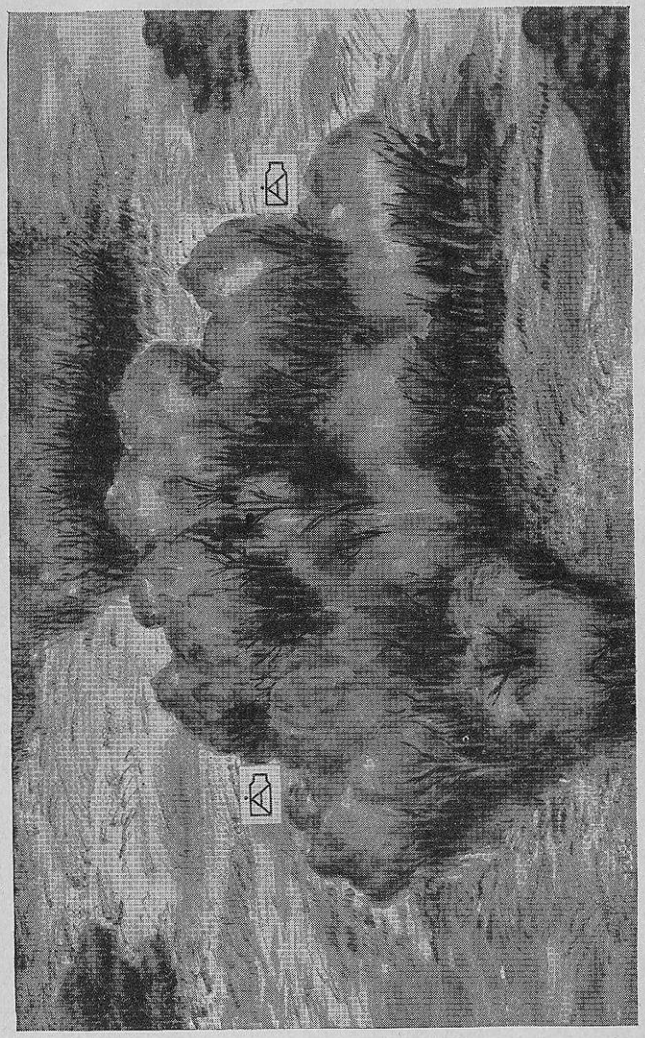

FIGURE 17.—If vehicles must be placed in edge of woods, place squads to supplement each other's sectors.

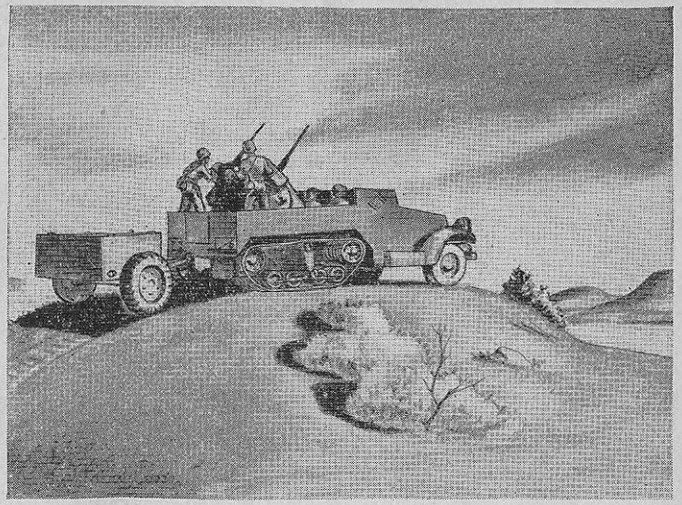

FIGURE 18.—Do not occupy a firing position on the crest of a hill. Such position affords good fields of fire but leads to ready discovery. Vehicles are also exposed to destruction by tank fire.

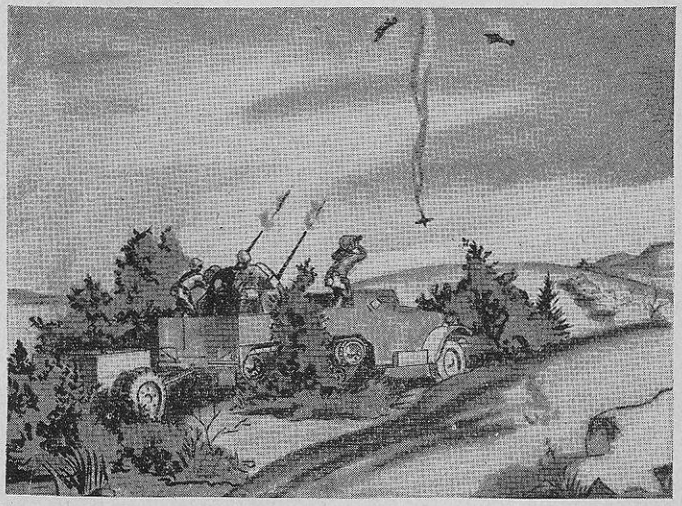

FIGURE 19.—Stop in level position behind crest if practicable. This is also a good antitank position.

FIGURE 20.—If level space cannot be found behind crest, place vehicles at either end of the hill. They can supplement each other's fire.

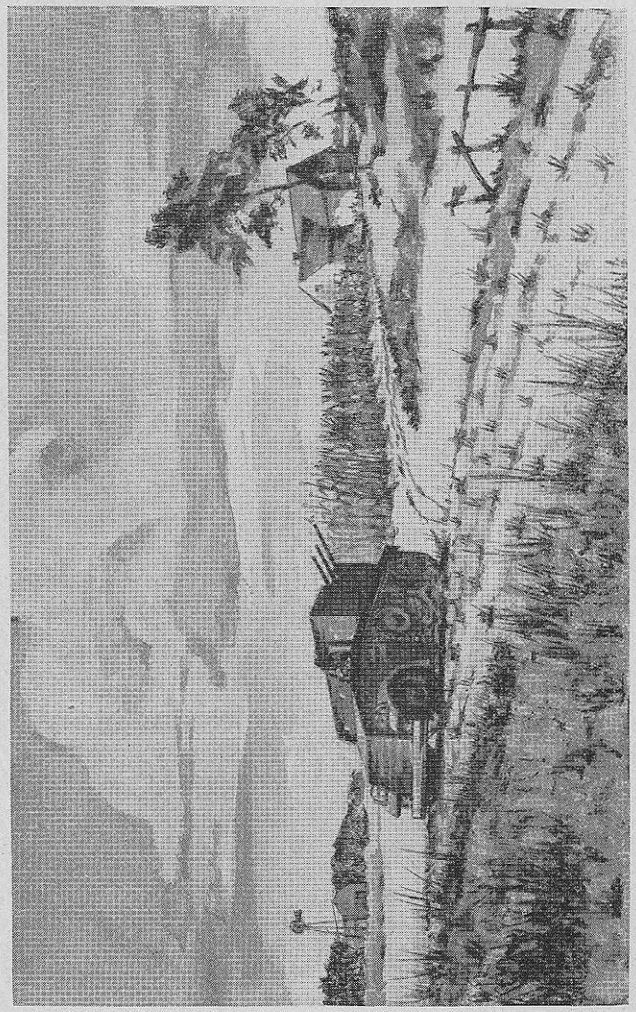

FIGURE 21.—Do not select position in open pasture when a field of corn will offer concealment.

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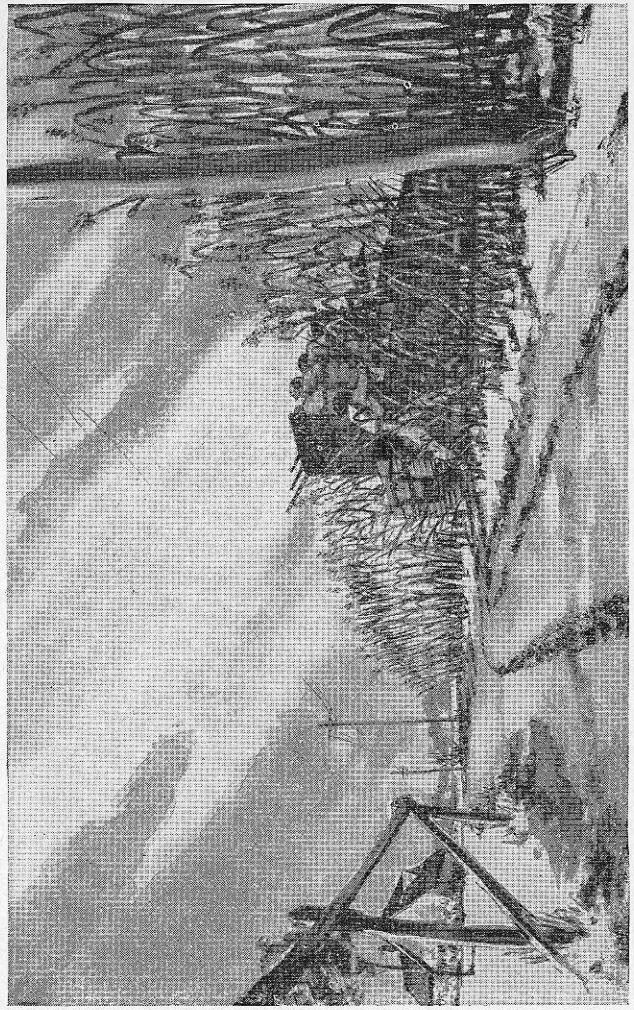

FIGURE 22.—Place mount in corn field.

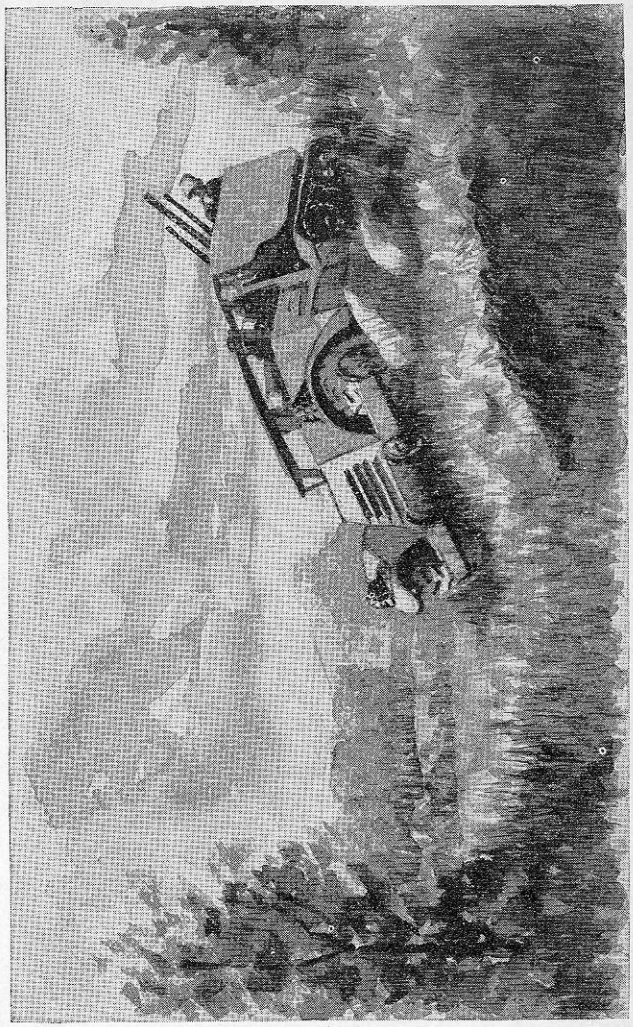

FIGURE 23.—Do not place vehicle on extremely sloping ground. Tracking will be difficult.

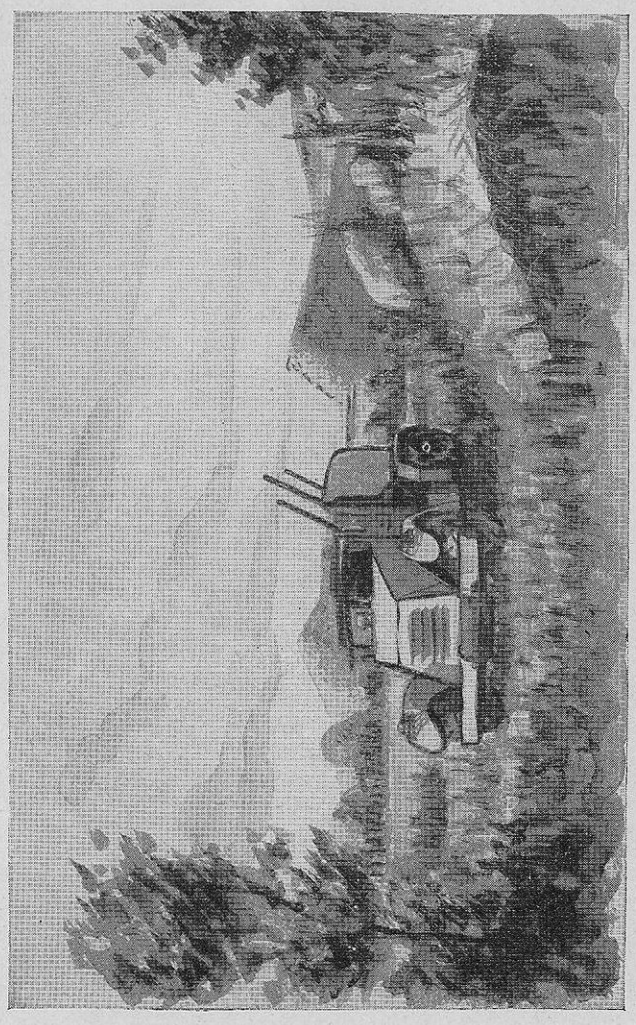

FIGURE 24.—Place vehicle on level ground.

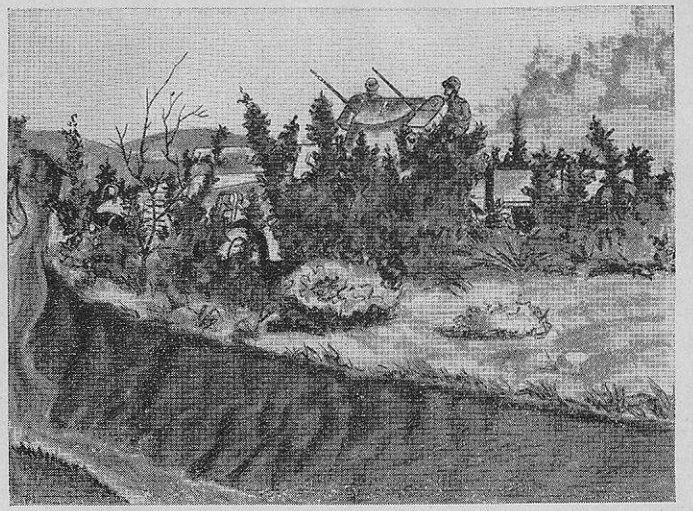

FIGURE 25.—Do not run the vehicle into a position which prevents its speedy movement to cover another sector. Here a ditch prevents movement.

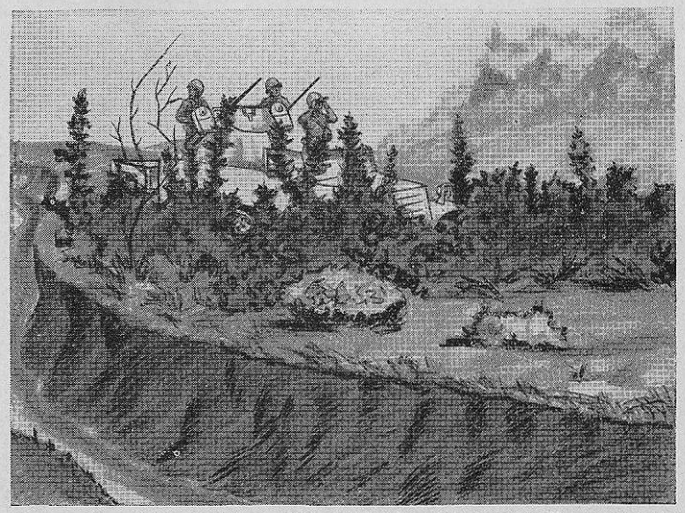

FIGURE 26.—Take position where vehicle may be readily moved to fire in another sector. Driver must be in his seat ready to move vehicle.

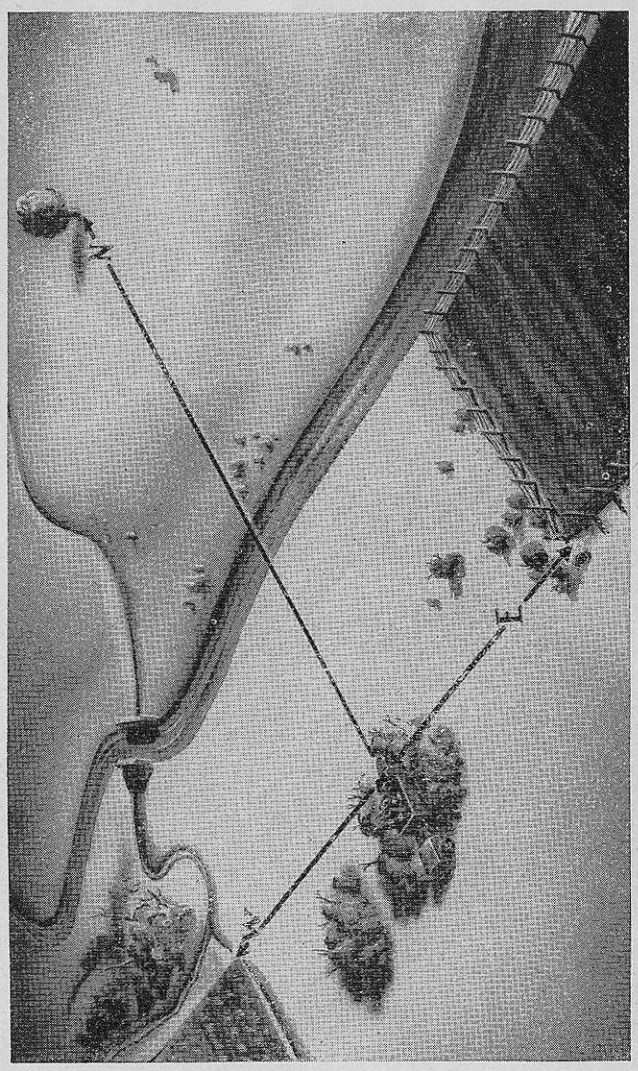

FIGURE 27.—Squad leaders orient themselves and their squads.

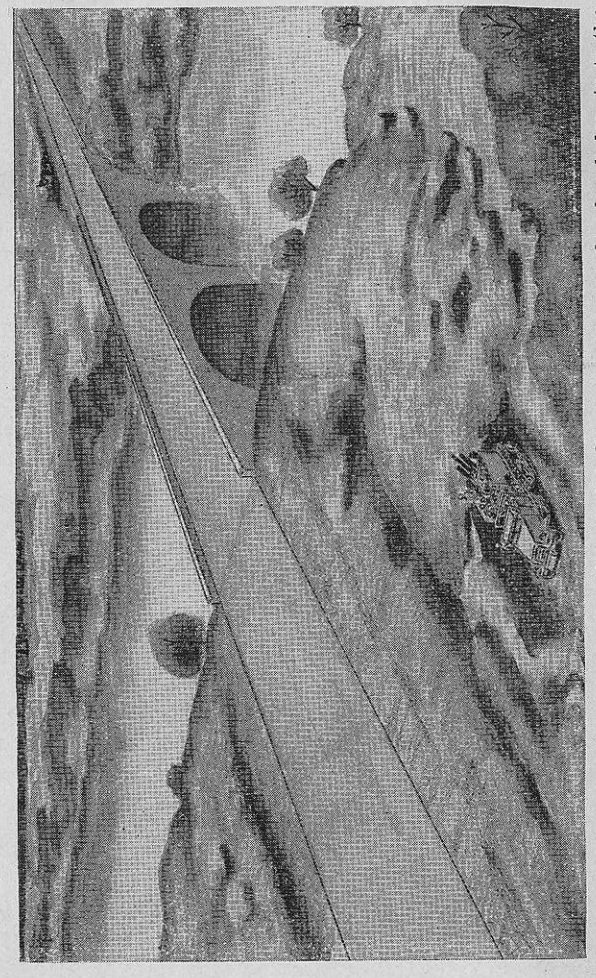

FIGURE 28.—In defending a bridge or other vital defile, some guns may be placed close in to the ends to protect against dive bombers provided sufficient units are available for normal dispositions. Place mounts in ditch or dig them in if time is available.

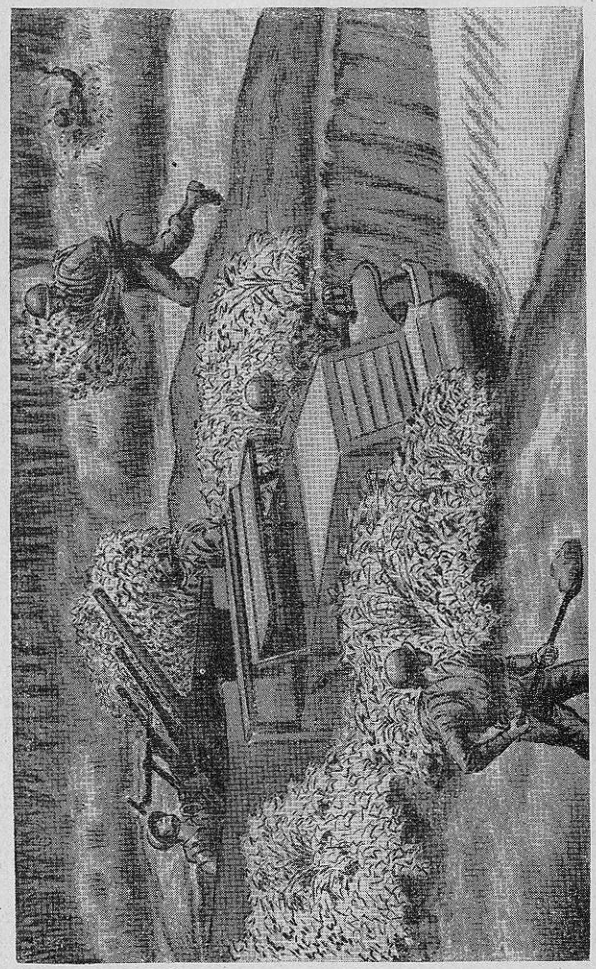

FIGURE 29.—In defense, vehicles are dug in and camouflaged if time is available. Pit is dug with ramp sloping to permit vehicle to move out readily.

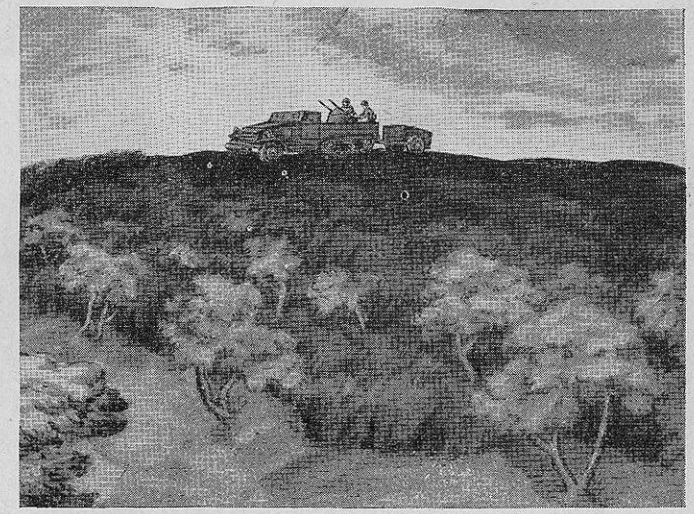

FIGURE 30.—Do not move into position by skyline route.

FIGURE 31.—Use covered route.

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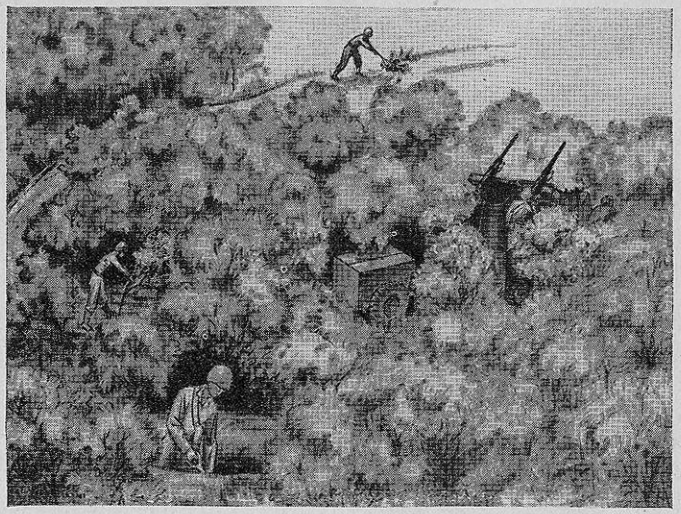

FIGURE 32.—When moving into position in brush or edge of woods, obliterate tracks.

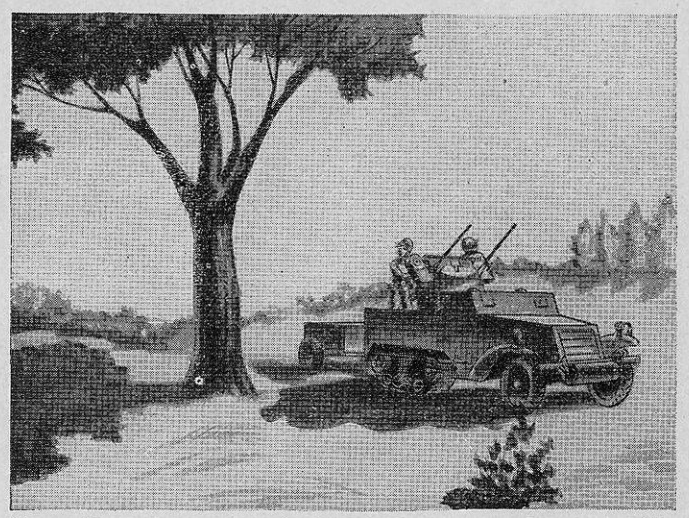

FIGURE 33.—When moving into position near trees do not halt in the sun.

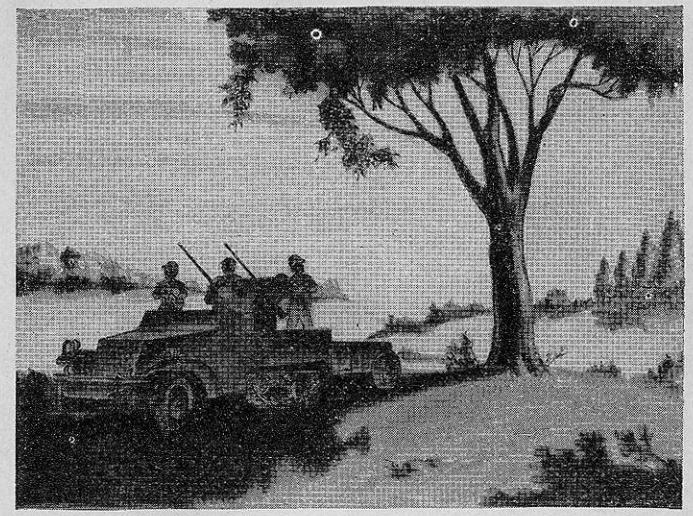

FIGURE 34.—Halt in shade and move vehicle as the shade moves.

CHAPTER 3

MOVEMENTS

	Paragraphs
SECTION I. Marches	22–24
II. Rail movements	25–26

SECTION I

MARCHES

■ 22. GENERAL.—*a.* Marches in general are covered in FM 100–5 and 25–10. Marches of armored units are covered in FM 17–50.

b. On the march during daylight AA units operate normally by section and protect marching troops by instant delivery of a heavy volume of fire on attacking planes. They are disposed throughout the column, the best protection being given to those units having the least number of organic AA weapons. Defiles require special protection by units previously emplaced. At night AA units, except those used for protection of troops that will arrive in bivouac after dawn, are grouped near the heads of columns where they can move quickly into position to protect bivouac areas. DO NOT DISTRIBUTE FIRE UNITS INDIVIDUALLY THROUGHOUT THE MARCH COLUMNS.

c. (1) Determination as to whether the firing batteries' maintenance sections march with the A or B echelons of the supported units' trains will depend upon the situation. The firing batteries' headquarters and communication sections will normally march with the supported units' headquarters.

(2) The battalion headquarters and the headquarters, operations, and communications sections of headquarters battery will normally march with the division headquarters forward echelon. The remainder of the battalion headquarters battery will normally march with the division trains.

■ 23. DAYLIGHT MARCHES.—*a.* In a daylight march, a suitable distribution of the AA battalion in the column(s) is one battery with each combat command, one platoon with the

division reserve, and two batteries, less a platoon, with the trains. This distribution will vary depending upon the size and composition of the combat command(s), the number of defiles to protect, and the contemplated use of the various elements of the command.

b. If defiles are to be protected, AA units detailed for their protection should move out with the reconnaissance battalion, go into position, and protect the defile until the division has passed through or until relieved by other AA units.

c. A section of AA machine guns should be with the support of the advance guard. Other guns are disposed *in pairs* to protect infantry, engineers, and trains of the column or the combat command.

d. In each vehicle, one man is navigator. He must know the route. He records the odometer (speedometer) reading at the beginning of the march and must know the location of his vehicle at all times.

■ 24. NIGHT MARCHES.—*a.* On bright moonlight nights the AA battalion operates as in daylight marches.

b. On dark nights those AA units not needed for protection of troops arriving in bivouac after dawn, march near the heads of columns. Immediately upon entering the new bivouac area, AA units are disposed for protection of that area.

c. On night marches care must be taken to prevent use of any but blackout lights. Rigid light discipline must be enforced.

d. The unit with which AA elements are marching is responsible for guides. However, each individual vehicle commander must know the route and must keep himself constantly oriented.

SECTION II

RAIL MOVEMENTS

■ 25. MOVEMENT BY RAIL ALONE.—*a.* Entraining and detraining are the most vulnerable phases of a rail movement. Sufficient AAA protection must be furnished the entraining and detraining points.

b. All organic AA weapons in the armored units in addi-

tion to AAA unit weapons must be continuously manned during entraining, the movement, and detraining.

c. Balance the AA protection of the trains, taking into consideration the fire power of the AA weapons in the armored units. Some trains may need no additional protection by AAA units.

d. DO NOT DISTRIBUTE THE AAA SQUADS ONE TO A TRAIN. Use a minimum of two AAA squads, preferably one mount at each end of the train (see fig. 35), on trains to which AAA protection is allocated. If more than two AAA squads are available per train, space these additional squads throughout the train. Place AAA squads on flat or gondola cars.

e. Enough AA weapons should be sent with the first train to insure initial protection of the detraining point. Similarly, enough AA protection must be retained at the entraining point to insure its protection until the last train leaves.

f. If corps or army furnishes AA protection for the entraining and detraining points, the AAA battalion loads with the armored units, and unloads and proceeds to bivouac with these units.

■ 26. COMBINED MOVEMENT BY RAIL AND MARCHING.—*a.* The AAA battalion must be apportioned between the rail and march elements, taking into consideration the organic AA weapons in the armored units, so as to insure the best protection for all elements.

b. Paragraph 25 is applicable to the AAA units accompanying the rail movement.

c. Paragraphs 23 and 24 are applicable to the AAA units accompanying the march.

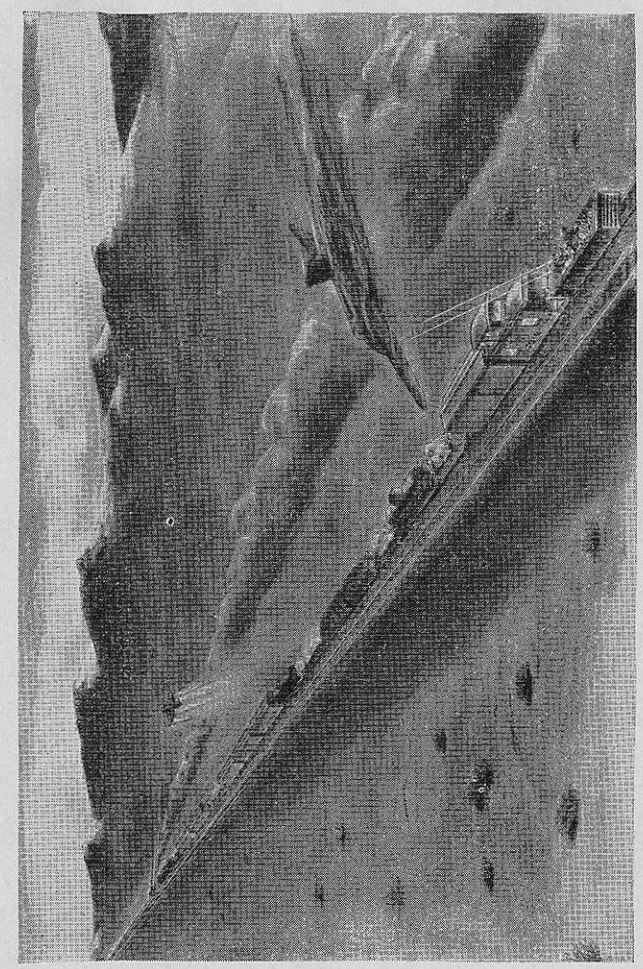

FIGURE 35.—Placing of AA guns on trains.

FIGURE 36.—Guns are distributed in pairs. The front crew should protect to the front, right, and left. The rear crew should protect to the rear, right, and left. 50 to 175 yards between vehicles.

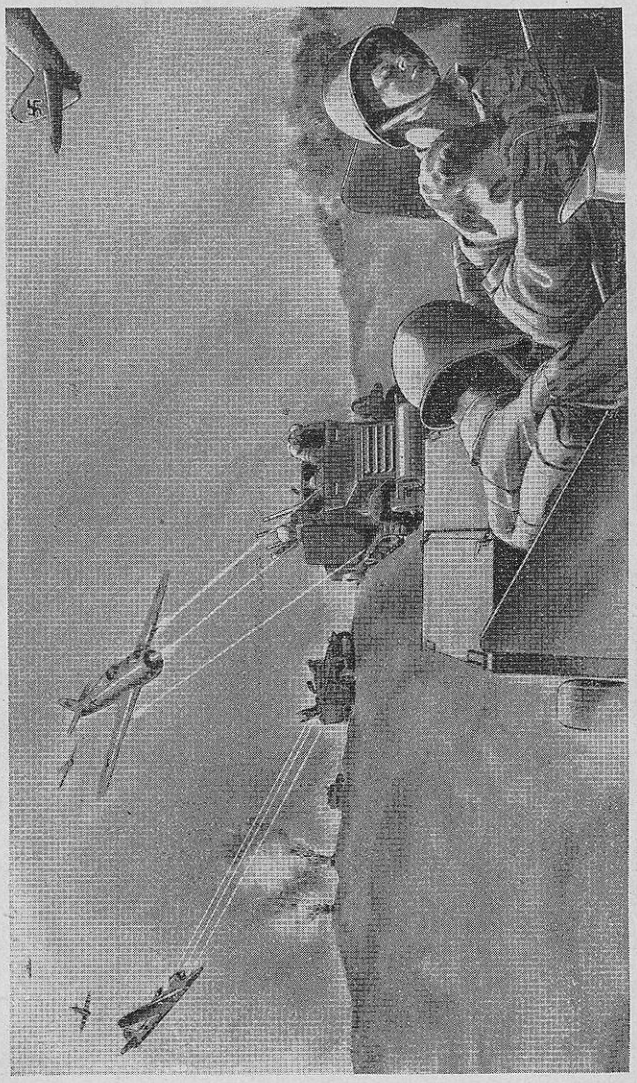

FIGURE 37.—Do not let men go to sleep.

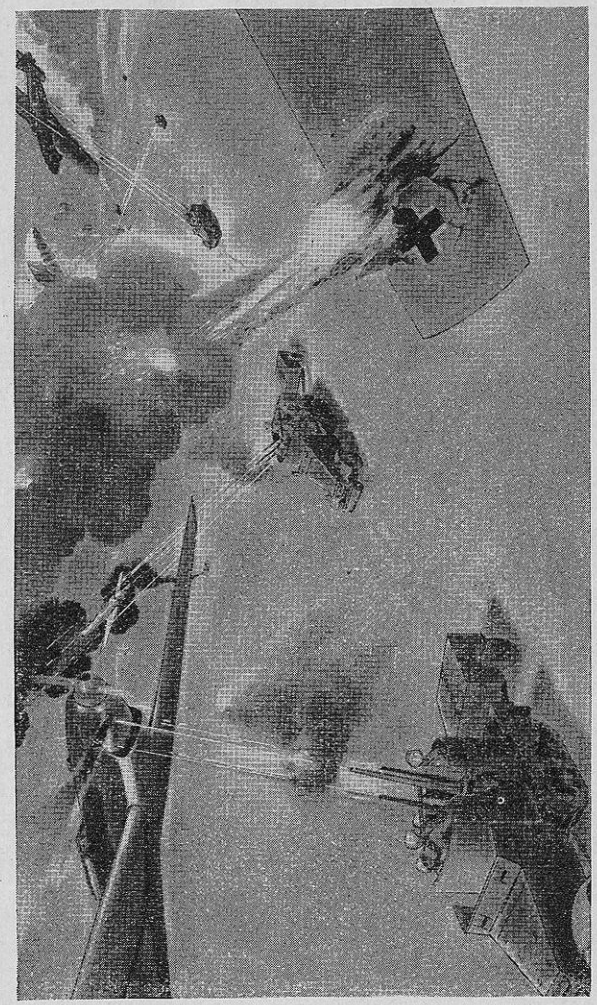

FIGURE 38.—Detail members of crew as air sentries. Keep radio receiver on air warning or unit command net.

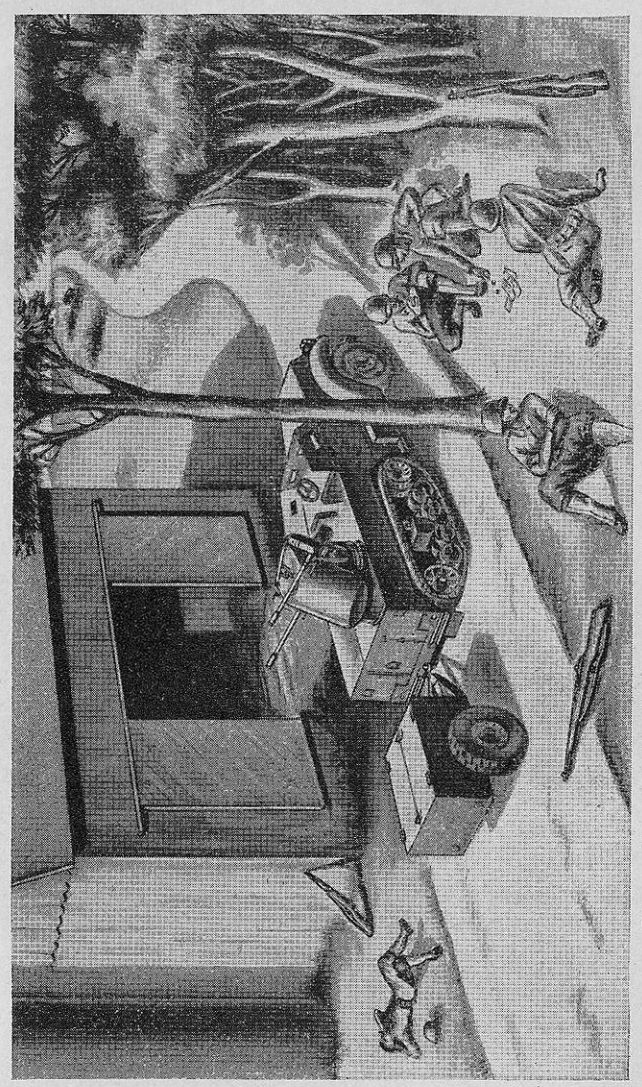

FIGURE 39.—At halts do not sit and do nothing. You are inviting trouble.

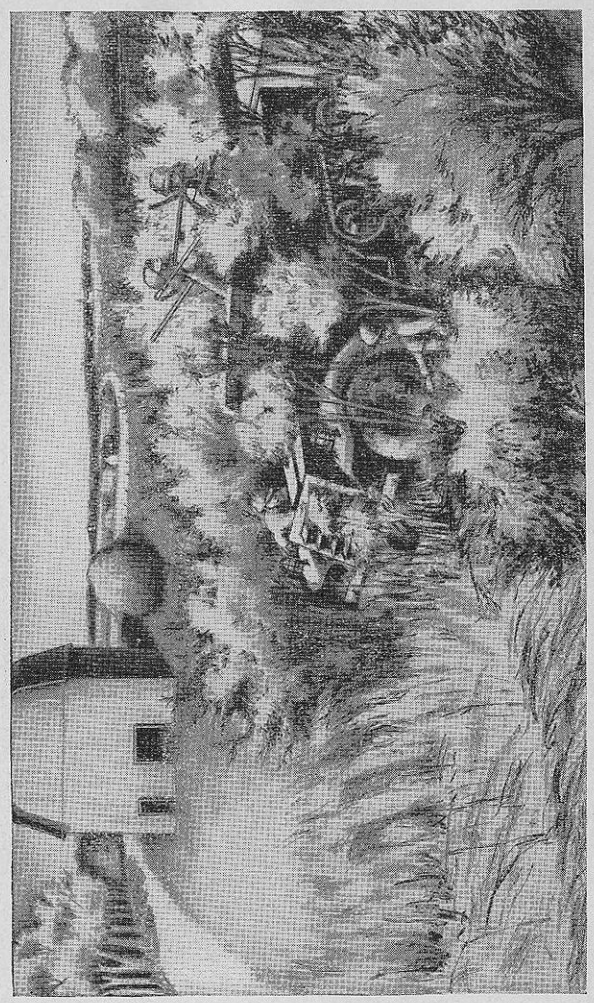

FIGURE 40.—Move vehicle to firing position near road. Keep man on guns. Have air sentries alert. Driver and squad leader inspect vehicle.

CHAPTER 4

BIVOUACS

■ 27. GENERAL.—*a.* In bivouac AA units protect against low-level, dive bombing, strafing, and airborne attack, and reinforce the antitank defenses.

b. The best bivouac protection is DISPERSION, CONCEALMENT AND RIGID CAMOUFLAGE DISCIPLINE. In a well-concealed bivouac, fire is opened on enemy airplanes only when the bivouac is actually attacked. Beware of firing on a lone enemy airplane. This airplane may be trying to draw fire to get you to disclose your bivouac location. Airplanes in pairs will often operate by one attempting to draw fire while the other radios the bivouac location. If you fire on a lone airplane attacking the bivouac, expect a heavy attack by a number of airplanes in a short time.

■ 28. MOVEMENT INTO BIVOUAC.—*a.* The location of the bivouac is indicated in orders of the unit with which the battery or platoon is marching. The battery commander or his representative goes to the bivouac with the billeting party. Here the bivouac locations of the various units of the column are obtained from the billeting officer. The battery commander or his representative then makes a map reconnaissance, plans dispositions, and makes such personal reconnaissance *as time will permit*. He plots on his map the proposed location of each platoon, section, or squad. Knowing the disposition of his squads in column, he plans to place them in position near the units with which they have been marching.

b. In the meantime squads move into bivouac with the unit with which they have been marching and immediately take temporary firing positions near that unit.

c. When plans for bivouac protection have been approved by the bivouac commander, squads are moved to their new positions. *Again brush out tracks.* Give guns sectors for fire. Place guns *in pairs* a minimum distance of 100 yards apart so one will supplement the other and all around fire can

be maintained. Take up positions so guns can quickly be shifted to cover another sector or repel a mechanized attack. Squad leaders make a rough sketch and orient themselves on the ground so they can instantly tell from which direction the attack is coming when warning is received.

d. For protection of small bivouac areas, a perimeter defense is used. For perimeter defense, weapons are placed near the bomb release line for the expected altitude and speed of attack, normally 600 or 700 yards from installations to be protected. Against dive bombing, positions should be closer but not nearer than 200 yards from installations. In large bivouacs, some guns are placed within the bivouac area if suitable firing positions are available.

e. For protection of railheads, truckheads and like installations, place weapons not closer than 200 yards from the installations. If enough weapons are available, two or more rings of weapons are installed.

■ 29. COMMUNICATION.—In bivouac, radio is usually silent except for air warning. However, each squad keeps its receiver tuned to the battery, air warning net, or other prescribed net over which warning will be broadcast. The battery commander keeps his medium power radio receiver on the air warning net and transmits air warnings to the gun squads on his FM set.

■ 30. SECURITY.—*a.* An air and a ground sentry are kept on the alert at each squad at all times.

b. AAA units must furnish their own local security. Adjacent ground units furnish incidental protection for guns close in. The outposts furnish incidental protection for guns farther out from the bivouac.

■ 31. CONDUCT DURING AIR ATTACK.—When warning of approaching hostile airplanes is received, the battery commander or platoon leader flashes the warning to the squads by radio, giving direction, altitude, number and type of airplanes if time permits. Squads are alerted and motors of vehicles are started should it prove necessary to move vehicles to alternate positions.

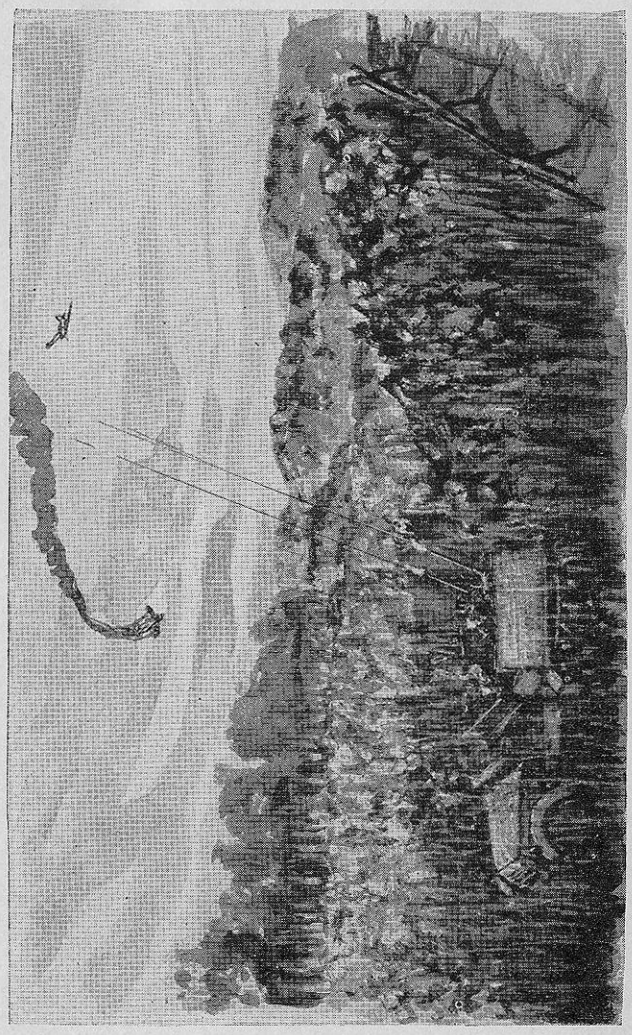

FIGURE 41.—When bivouac is well concealed, do not fire at airplanes *unless bivouac is attacked.*

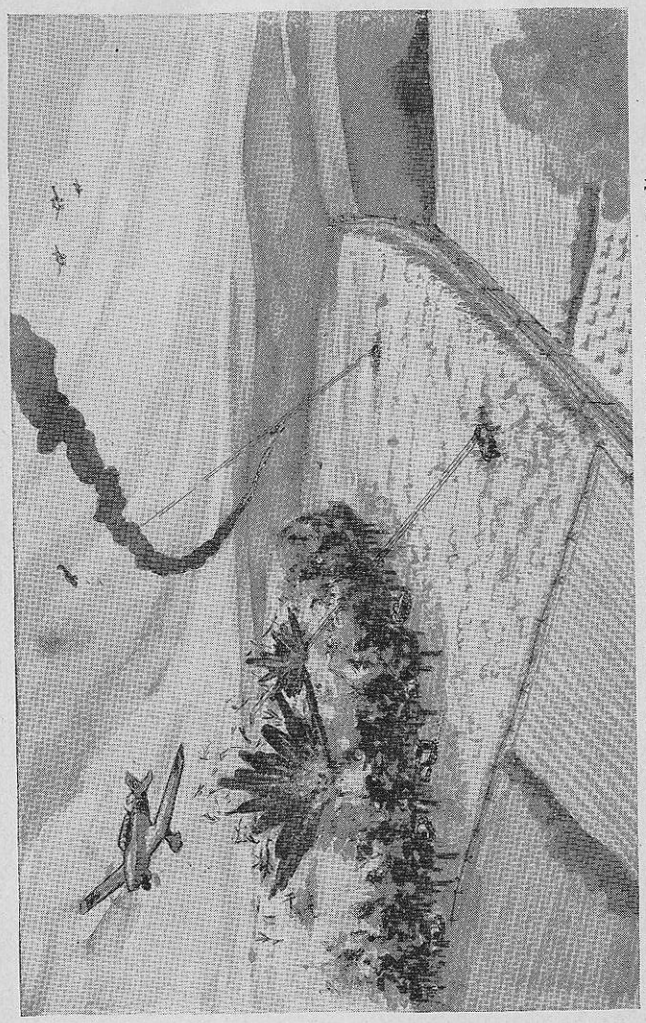

FIGURE 42.—You will disclose position and heavy attack may result.

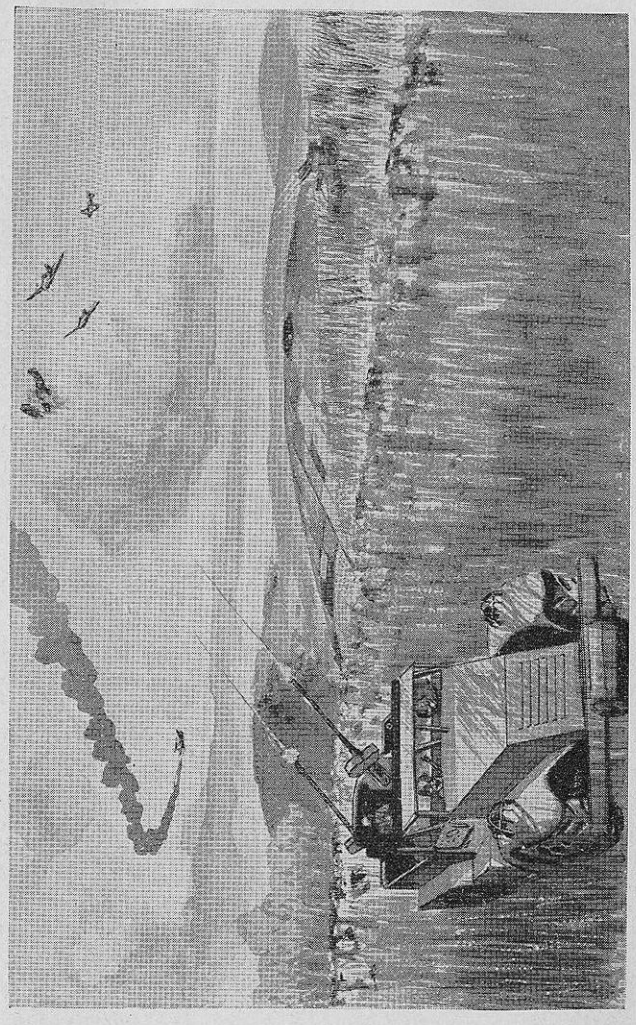

FIGURE 43.—When attacked, fire rapidly when airplanes are in range.

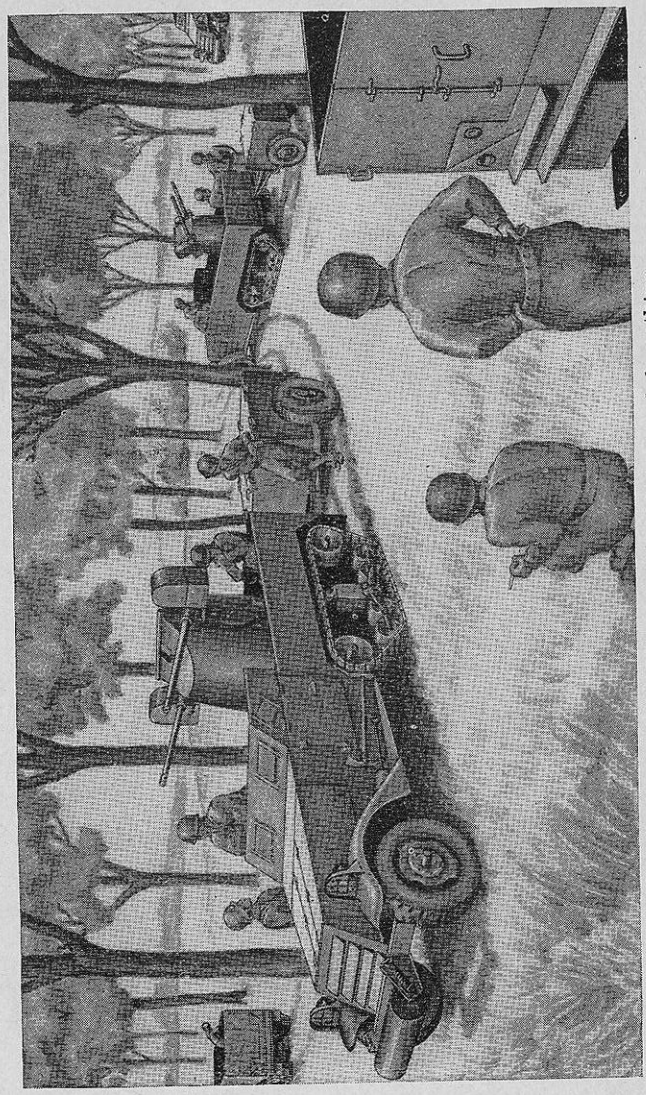

FIGURE 44.—Do not move into bivouac and do nothing.

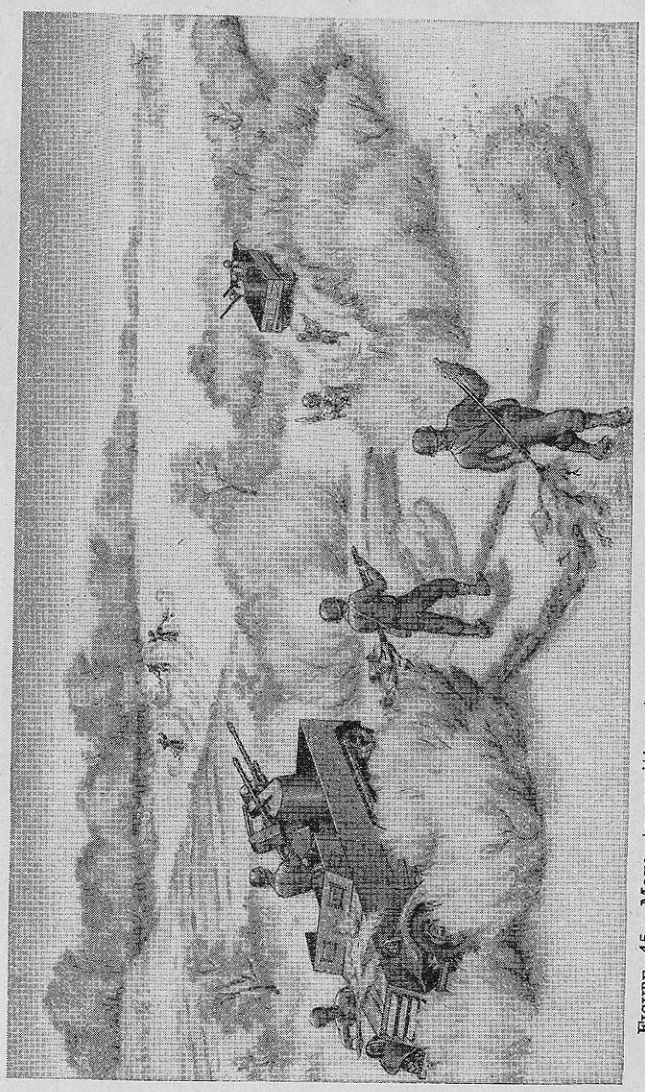

FIGURE 45.—Move to position to protect bivouac. Camouflage vehicle. Brush out tracks.

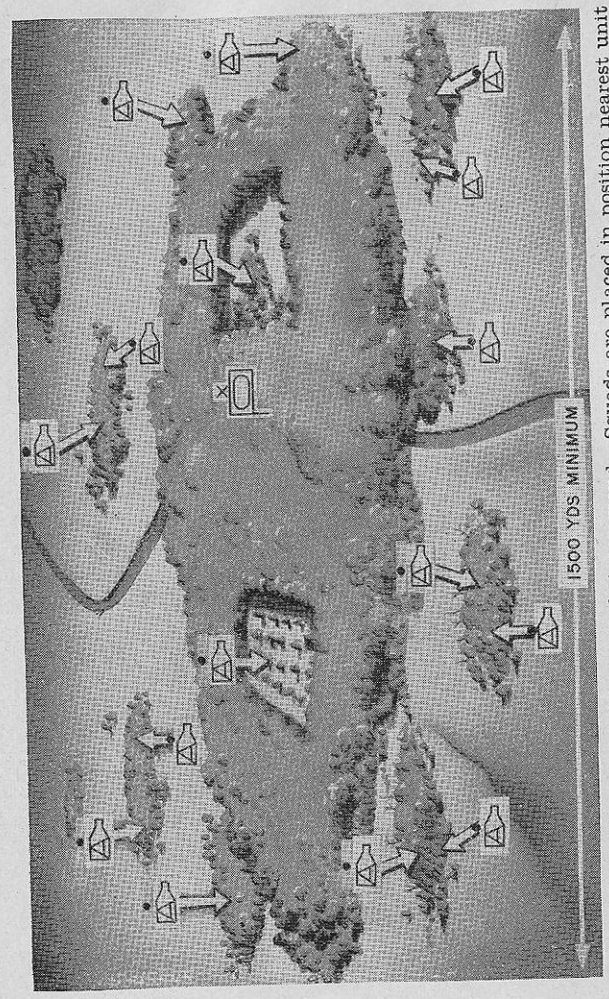

FIGURE 46.—Battery protecting a combat command. Squads are placed in position nearest unit with which they have been marching. If practicable, site guns also for antitank protection.

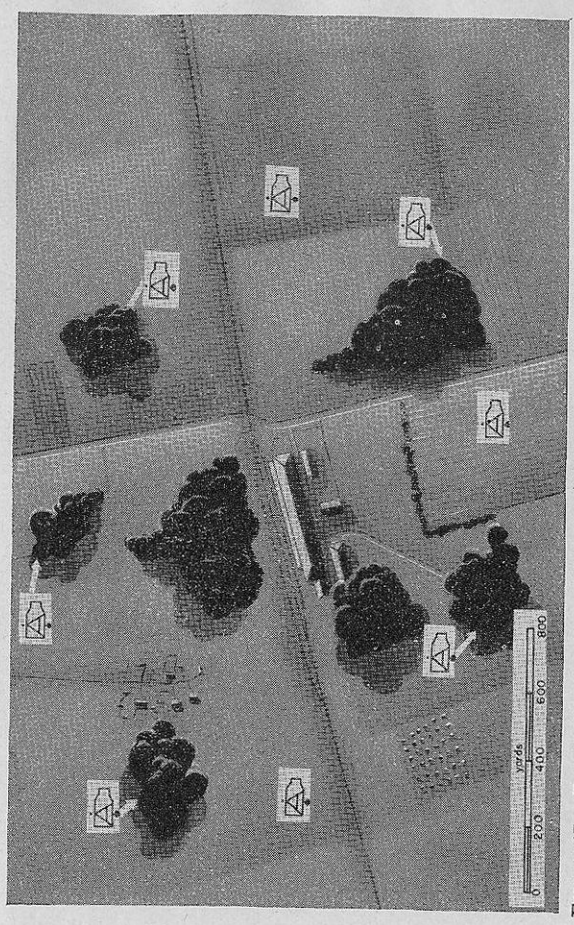

FIGURE 47.—For protection of a railhead against low-level bombing, place guns 600 to 800 yards from center of area to be protected. Use them also for antitank protection. The gun platoon is best for railhead protection. For protection against dive bombing, place some guns 200 to 300 yards from center of area. Figure shows one platoon. If a battery is available, form an inner ring of defense with machine-gun squads.

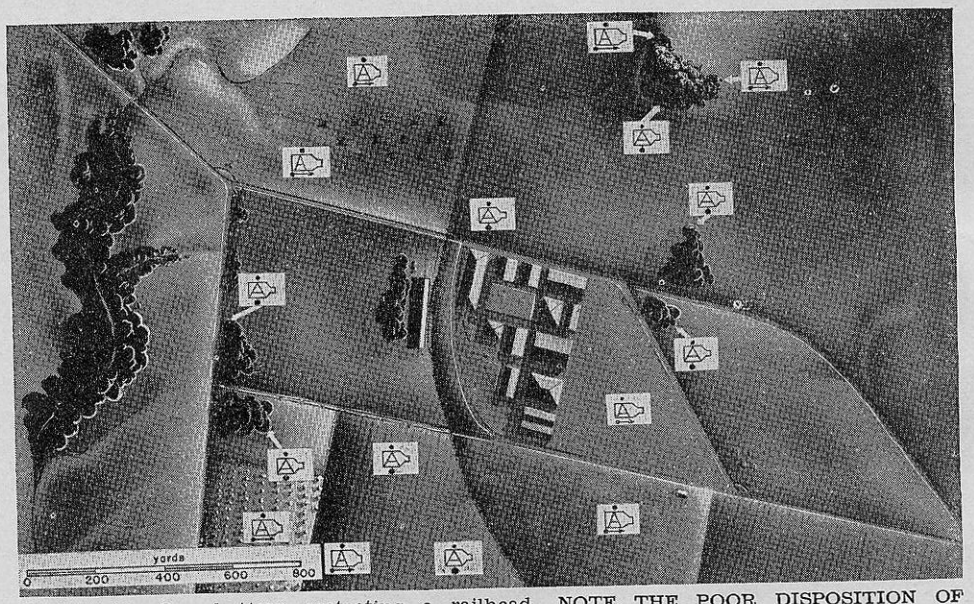

FIGURE 48.—One battery protecting a railhead. NOTE THE POOR DISPOSITION OF MACHINE-GUN SQUADS ( ). THEY SHOULD FORM AN INNER DEFENSE RING.

FIGURE 49.—Protection of truckhead. Cover road blocks if practicable in addition to giving air protection.

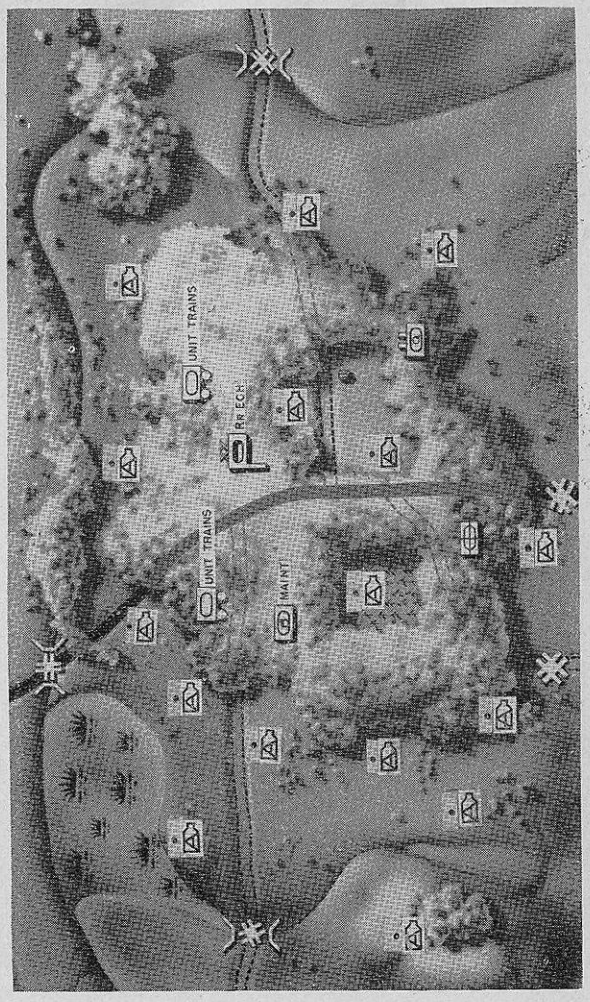

FIGURE 50.—One method of protecting train bivouac. Cover service parks, medical installations, unit trains B echelon. Protect road block if practicable.

CHAPTER 5

OFFENSIVE ACTION

■ 32. GENERAL.—*a.* On the offensive AA units protect trains, defiles, artillery while firing, reserves, infantry, and engineers in the advance and when removing obstacles, and assist in repelling mechanized counterattacks. DO NOT DISTRIBUTE FIRE UNITS INDIVIDUALLY THROUGHOUT THE ENTIRE ZONE OF DIVISION ACTION.

b. AA units cannot be expected to follow the leading waves of a tank attack as the vehicles are too lightly armored.

■ 33. MEETING ENGAGEMENTS.—In a meeting engagement, armored units usually attack direct from march column. AA units with the column protect defiles, troops deploying for attack, and artillery supporting the deployment. There will be little time for regrouping of AA weapons and only enough regrouping is accomplished to protect vital elements and points.

■ 34. ATTACK FROM ASSEMBLY AREA.—*a.* In attack from assembly area, armored units usually attack in three echelons, each echelon in a series of waves. (See FM 17–100.)

b. Armored units occupy an assembly position for a short time only. AA squads with the columns take up temporary firing positions to protect this assembly area as for bivouac. (See par. 28.)

■ 35. PURSUIT.—In pursuit by encirclement, place AA elements with the reserve and the advance guard. The enemy will seek to hold up the heads of columns. In pursuit after break-through, have AA units well forward to protect defiles.

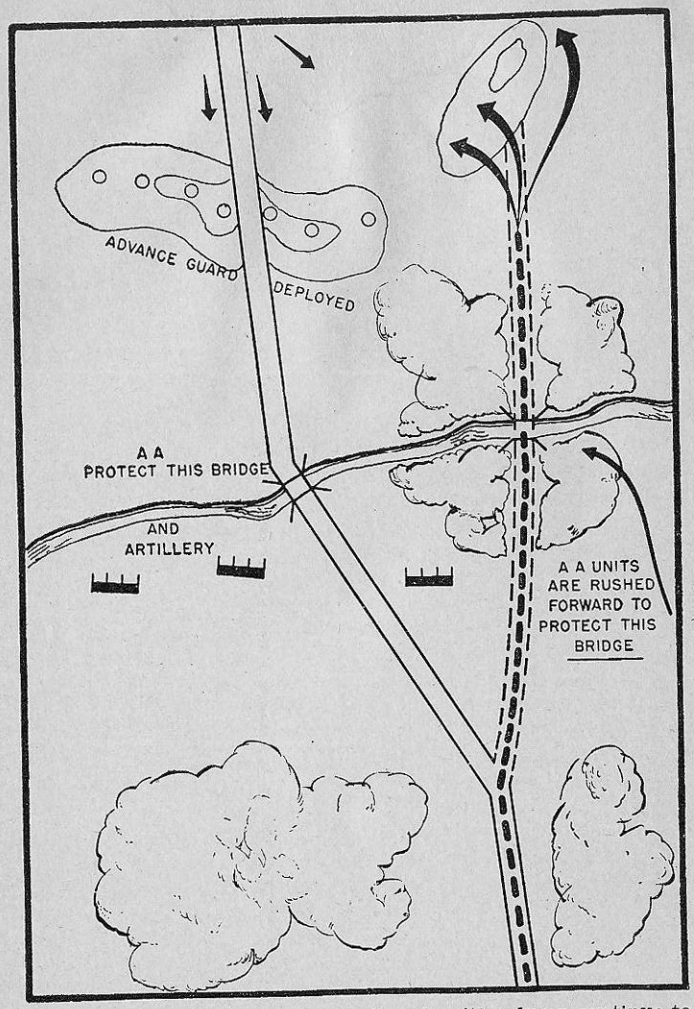

FIGURE 51.—Meeting engagement. Squads with column continue to protect those elements with which they are marching except as indicated.

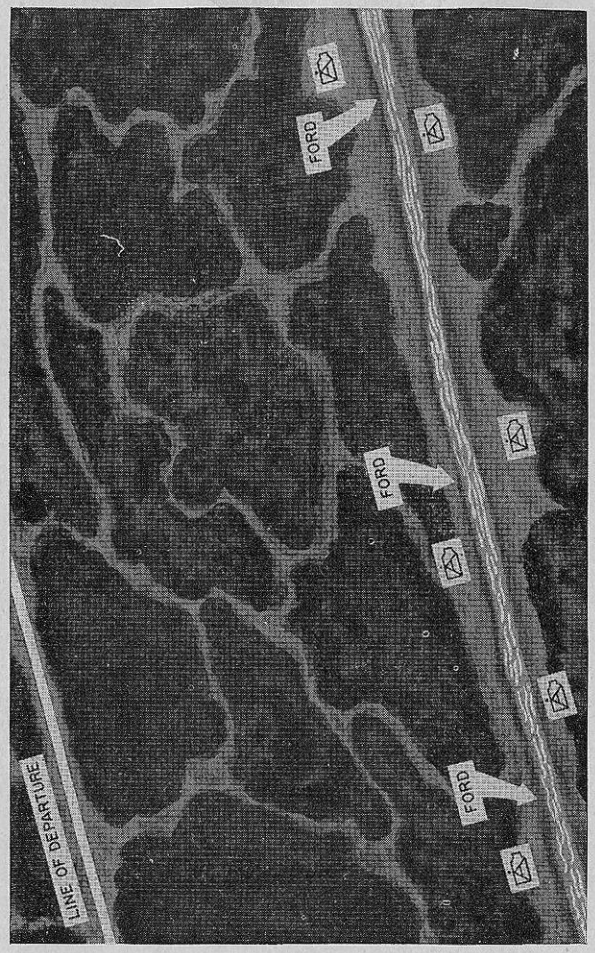

FIGURE 52.—In attack from assembly areas, AAA protects defiles or stream crossings between assembly areas and the line of departure. Send AA units ahead for this mission.

FIGURE 53.—AA units protect reserve.

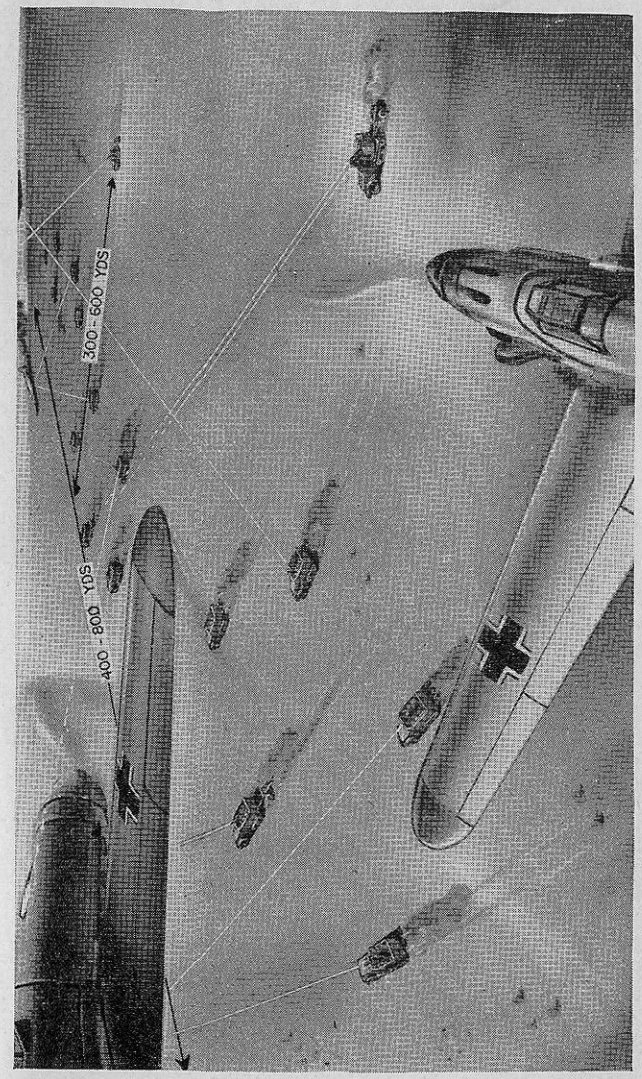

FIGURE 54.—When combat command attacks with infantry in third echelon, AA units protect infantry.

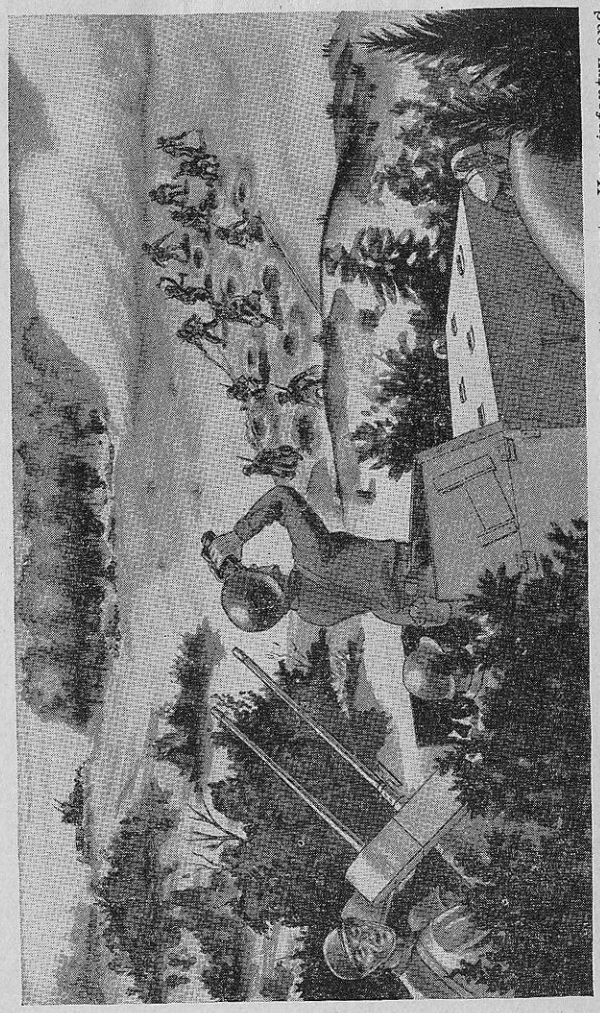

FIGURE 55.—When infantry and engineers attack first, AA units support. Here infantry and engineers are removing mines.

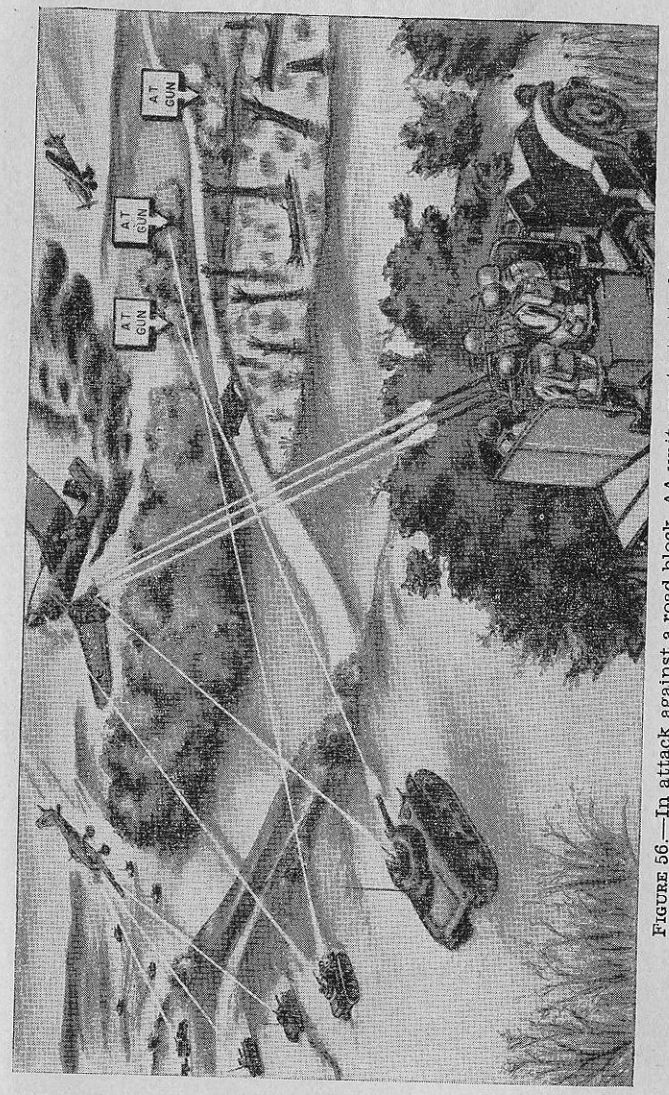

FIGURE 56.—In attack against a road block, AA units protect attacking troops.

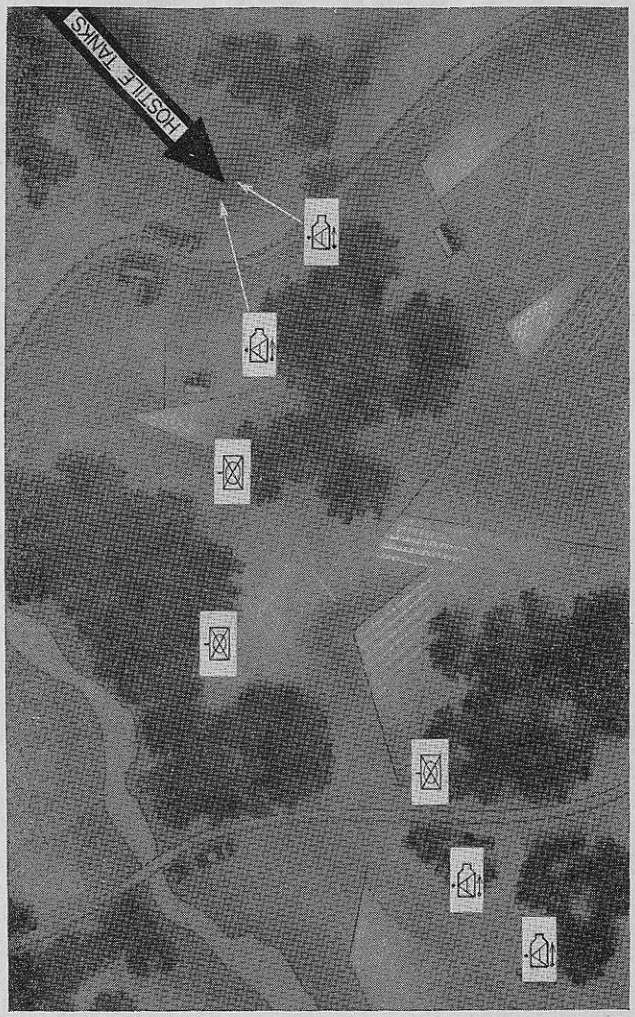

FIGURE 57.—When advancing with infantry, AA squads present aid in protection from tank attack.

CHAPTER 6

DEFENSIVE ACTION

■ 36. GENERAL.—*a.* For operation of the armored division in defense, see FM 17–10 and 17–100.

b. In defense the normal mission of the AA battalion is the protection of reserves, artillery and trains, and infantry in position. The contingent mission is antitank defense. DO NOT DISTRIBUTE FIRE UNITS INDIVIDUALLY THROUGHOUT THE ENTIRE ZONE OF DIVISION ACTION.

■ 37. ACTION WITH ARMORED DIVISION AS PART OF A LARGER FORCE.—*a.* As part of a larger force in defense, the armored division is held intact in a concealed reserve position beyond hostile medium artillery range. It is used to counterattack the enemy forming for an attack; to restore a position where the enemy has succeeded in penetrating our lines; to repel a flank attack; or to take the offensive should an opportunity present itself. However, its action is offensive in character.

b. In defense little aid can usually be expected from friendly fighter aviation. The AA battalion must furnish the bulk of protection from air attack. It is imperative that the combat units receive the maximum protection possible as the enemy, once he has discovered an armored division reserve position, will attempt to strafe and dive bomb it heavily. *Again it must be emphasized that thorough concealment must be obtained and rigid camouflage discipline enforced. Do not disclose the division's position by emplacing poorly concealed guns or by firing unless the defensive position is attacked in force. A ring of poorly concealed guns around a bivouac area accurately designates such area for enemy air bombardment.*

c. The battalion commander should—

(1) Make recommendations for the distribution of batteries for the protection of trains and the division area.

(2) Plan the AA protection of the reserve position, order units into position, and inspect them.

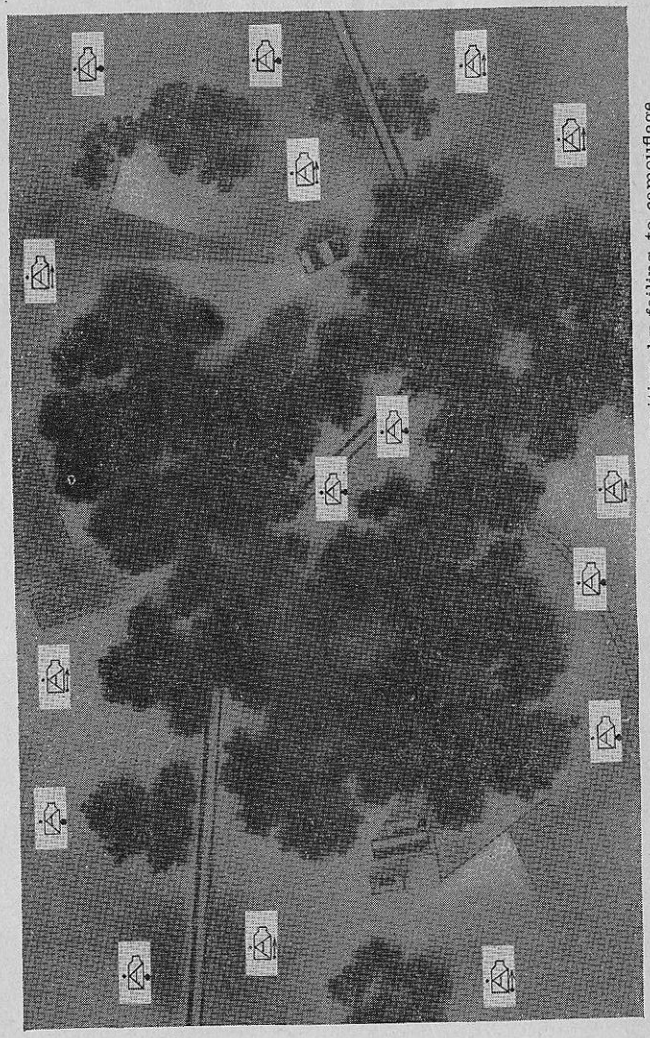

FIGURE 58.—Do not disclose location of reserve position by failing to camouflage.

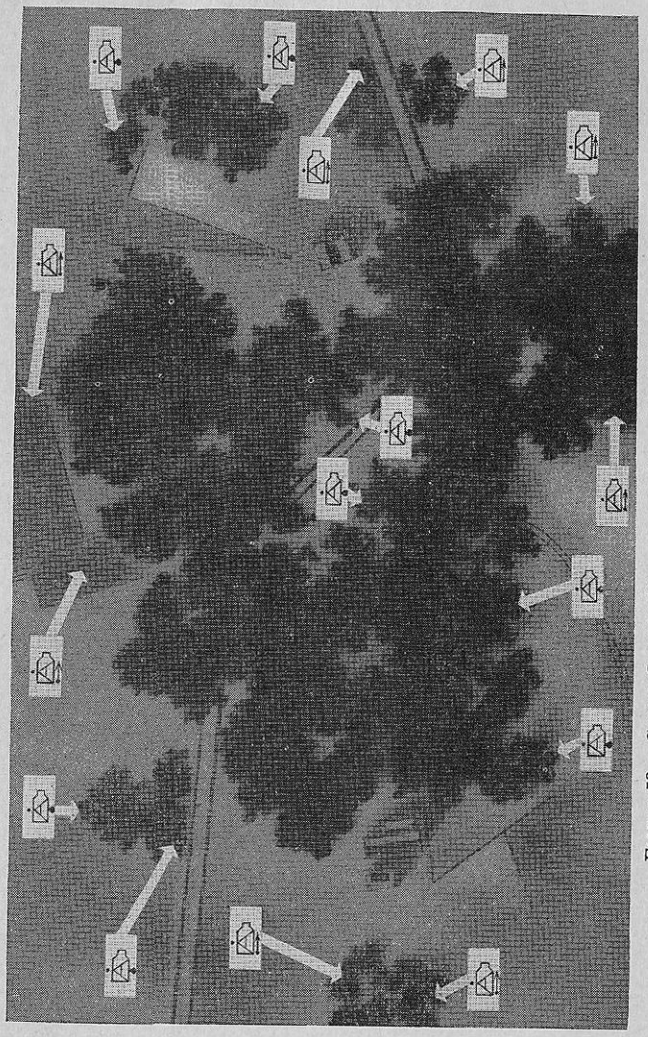

FIGURE 59.—Camouflage in the open or place squads in edge of woods.

(3) Obtain the division commander's plans for future offensive use of the division and plan the use of AA units to support each proposed plan. In this connection he should—

(*a*) Study the terrain between the reserve position and proposed attack positions or line of departure. Consult the division engineer. Locate defiles and make a personal reconnaissance of such defiles.

(*b*) Detail units to protect each defile that may be used for each particular plan and cause unit commanders to make personal reconnaissance of defiles they are to protect and a reconnaissance of routes thereto. Covered routes, if available, are selected.

(*c*) Coordinate plans for movement of AA units to positions to protect defiles, artillery, and such other installations or units as required. AA units should move out immediately behind reconnaissance units if defiles are to be protected. If detailed to protect a unit, they move out with that particular unit.

(*d*) Make provision for AA units to move early if the division is to make a night movement and occupy assembly areas or attack positions prior to daylight. AA units move with the reconnaissance elements and occupy protective positions before the main body of troops arrives.

d. In the counterattack AA elements are employed as in offensive action. (See ch. 5.)

■ 38. ACTION WHEN THE ARMORED DIVISION IS OPERATING ALONE.—*a.* The armored division defends alone by occupying the main line of resistance with its infantry supported by artillery and medium tanks, and using the remainder of the tanks and the tank destroyer battalion as a reserve. (See FM 17–100.) The reconnaissance battalion, reinforced by the reconnaissance companies of the armored regiments, engineers, light tank units and artillery as necessary, forms a counterreconnaissance screen and withdraws to flanks when forced back. AA units in this operation are used to—

(1) Assist reconnaissance units in defending road blocks.
(2) Protect artillery.
(3) Protect infantry in position.
(4) Protect reserves.
(5) Protect trains.

b. The counterreconnaissance screen will use road blocks to slow the enemy advance and give the division time to organize the defense. Each such road block is defended by machine guns and antitank guns. To reduce these road blocks, the enemy will often call for the support of dive bombers or even low-level bombardment, for attack on the defenders. Squads of AAA, preferably the automatic weapons squads, should be with the counterreconnaissance units to protect against such air attack.

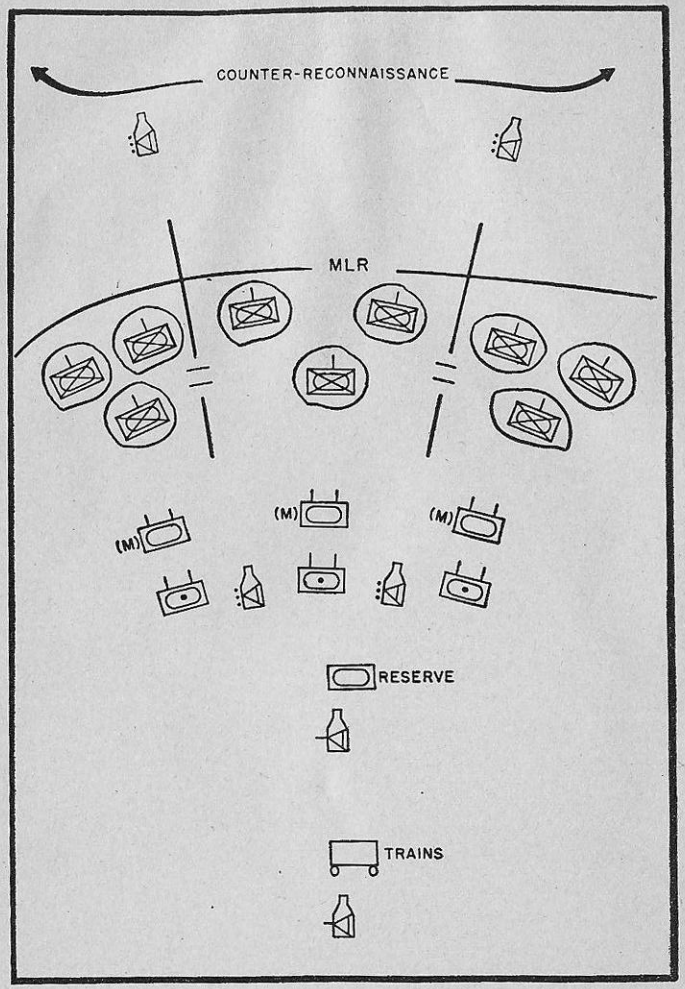

FIGURE 60.—Schematic arrangement of an armored division in defense when acting alone.

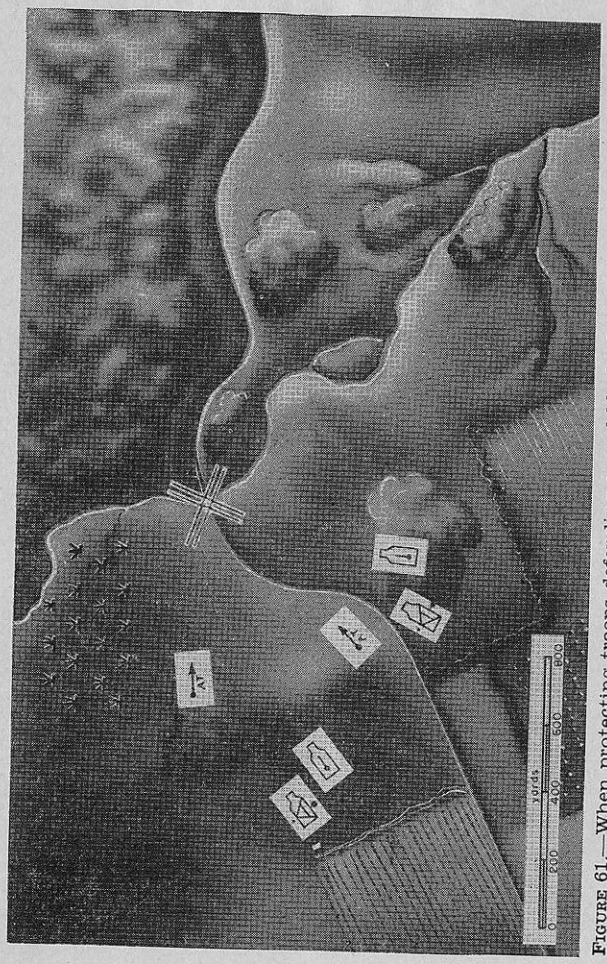

FIGURE 61.—When protecting troops defending a road block, do not place AA squads next to antitank guns of defending troops. If the enemy locates them, you will also become a target. Turn vehicles so they can readily be driven away.

FIGURE 62.—Place guns where they can protect defending troops from both air and ground attack but will not be discovered by enemy troops attacking the road block. Squads are located in pairs and are at least 200 yards from the troops or installations they protect.

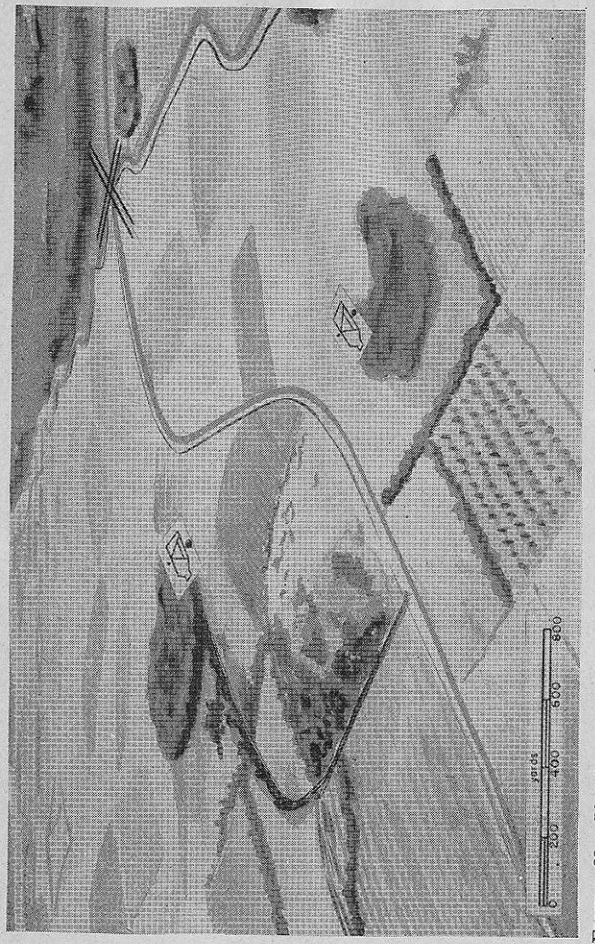

FIGURE 63.—If AA guns must assist in the ground defense of the road block, place them in position so vehicles can move quickly to the rear under cover. Select alternate positions.

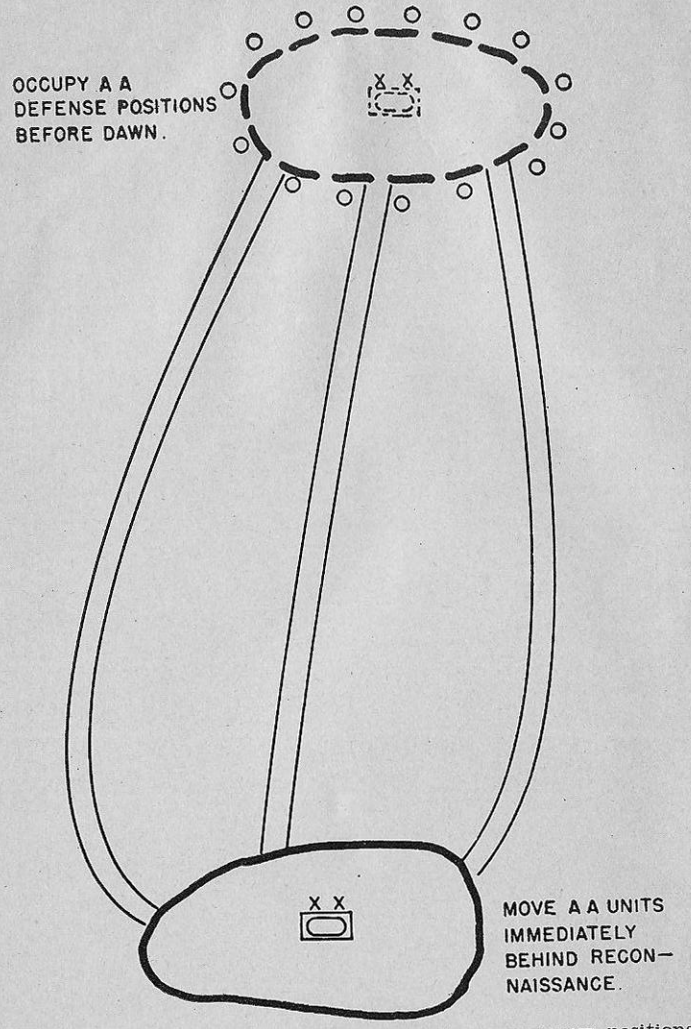

FIGURE 64.—If division moves at night to occupy new positions before dawn, send AA units ahead to occupy AA defense positions. These AA units must be protected.

CHAPTER 7

RETROGRADE MOVEMENTS

■ 39. GENERAL.—A retrograde movement, except one that is executed for the purpose of making an immediate attack in some other area, will usually be hindered by heavy hostile air attacks. Rarely can we expect to have air superiority to aid in the withdrawal of our troops. The enemy, once he has found we are withdrawing, will redouble his efforts and will use every available means under his control to destroy us. The most vulnerable points are defiles where a successful bombing may block the withdrawal of troops. Trains must be protected. Withdrawing troops must have AA protection. The covering force and rear guards should have AA elements attached. DO NOT DISTRIBUTE FIRE UNITS INDIVIDUALLY THROUGHOUT THE ENTIRE ZONE OF ACTION.

■ 40. WITHDRAWAL.—(See FM 100–5 and 17–100.) In withdrawal the commander selects a rear position, moves his trains to the rear, forms a covering force from available units, and starts withdrawal of the least engaged units. If possible, he holds out until dark and withdraws under cover of darkness.

a. Night withdrawal.—In a night withdrawal—

(1) Send some AA units, preferably a battery, with the trains to protect them in their new train bivouac.

(2) Provide ample AA protection for defiles through which the division must withdraw. Place AA elements in position at these defiles and withdraw them with the rear guard. Furnish additional ground units for the defense of the defiles.

(3) Attach the remainder of the AA battalion to the covering force.

b. Daylight withdrawal.—A daylight withdrawal is a difficult operation and usually results in severe losses. When acting as part of a larger unit, the armored division attacks to assist other troops to withdraw.

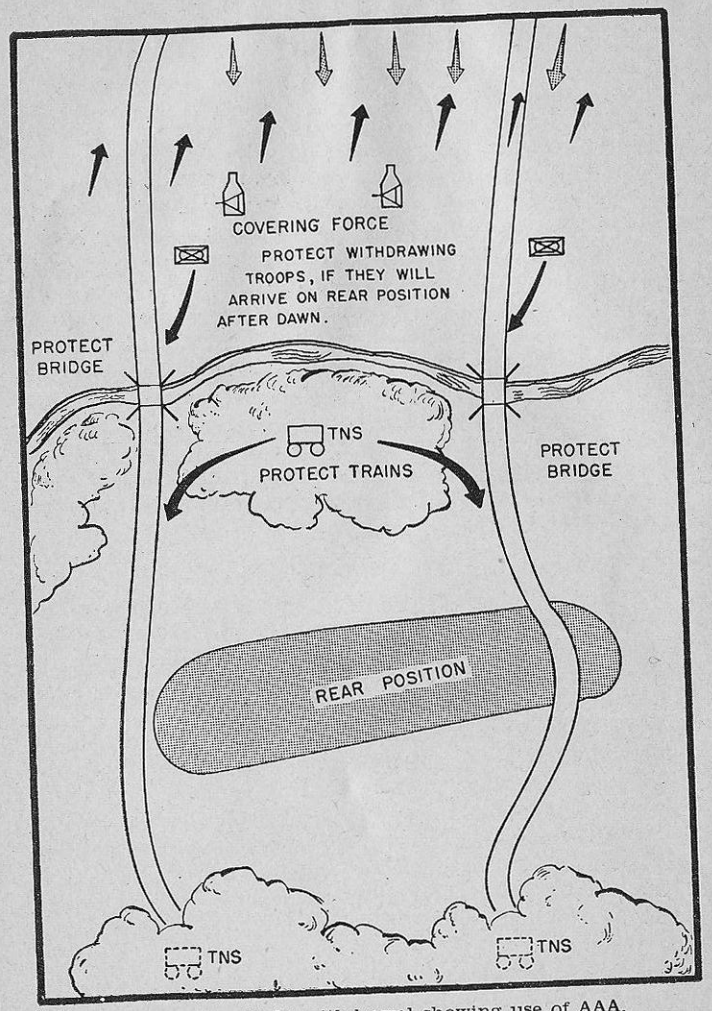

FIGURE 65.—Night withdrawal showing use of AAA.

The operation of the AAA will be similar to its action in the offensive. (See ch. 5.) When the armored division acting alone withdraws, AAA is used as follows:

(1) Part of the AA elements with the division trains withdraw with those trains. Part of the AA elements with the trains proceed to the rear and protect defiles through which the division must withdraw.

(2) All available AAA in the forward area is concentrated to assist the withdrawal of the most heavily engaged infantry. Tanks counterattack to disengage this infantry.

(3) When infantry is mounted in vehicles and starts withdrawing, a portion of the AAA accompanies it. The remainder of the AA units are attached to the covering force.

(4) As part of the covering force, AAA is used primarily to protect artillery and engineer units. They particularly protect engineers during demolition work. They must be ready to assist in antitank defense.

c. Rear guard.—When contact is broken and rear guards are formed, AA units, preferably a platoon or larger, are attached to each rear guard. These units usually march with the support of the rear guard and have, as their primary mission, the duty of protecting engineers during demolition operations. Their secondary mission is antitank defense.

■ 41. DELAYING ACTION.—In delaying action, AA units—

a. Operate with forward elements to protect them from both air and mechanized attack and to assist in withdrawal to rear delaying positions. The number of squads will depend upon the size of the delaying force and the front covered. There should be at least one squad for each 600 yards of front. Squads normally operate in pairs.

b. Protect reserves.

c. Protect trains.

d. Protect defiles.

■ 42. RETIREMENT.—In retirement AAA is disposed throughout the column as in the advance.

CHAPTER 8

SPECIAL OPERATIONS

■ 43. ATTACK OF A RIVER LINE.—*a.* FM 17–100 describes methods used by the armored division in attacking a river line.

(1) The greater portion of the AA battalion is used to protect the main crossing site. It protects bridges seized before the enemy has time to demolish them. If no bridges have been seized, it protects the initial crossing by infantry in assault boats, the ferrying operation, the construction of the bridge, and protects the bridge until relieved by AA units of higher echelons or until ordered to other duty.

(2) Part of the battalion is used to protect the trains and the reserves.

(3) *A few guns must be used to protect feint crossings, otherwise AA fire will disclose the real crossing point.*

b. AA units detailed to protect the crossing march immediately behind the advance guards at night. If movement is by daylight they protect the engineers in their movement to the river.

c. Prior to the movement to the river, the battalion commander obtains by map study, from G–2 and from the division engineer, all available data concerning favorable crossing sites and the terrain adjacent thereto. He is particularly interested in open fields near the river for gun positions. He, his battery commanders, and such staff officers as he desires to take with him, move forward with the engineer reconnaissance parties. They should take some members either of headquarters or gun squads to post as guides. This party—

(1) Reconnoiters for firing positions to protect probable points of crossing.

(2) Marks gun positions on maps, aerial photographs, or overlays for each point.

(3) Makes definite plans for occupying positions.

(4) Makes plans for early crossing of some AA units and

tentatively selects firing positions either from the map, aerial photographs, or by inspection from an observation point. When the crossing site has been selected, guides are posted to lead platoons into position. Battery commanders rejoin their batteries and issue necessary orders.

d. Selection of positions.—Positions are selected—

(1) To give all around (360°) protection.

(2) Not closer than 200 yards of the bridge site, except as indicated in (6) below, because the AA weapons may be destroyed by hostile artillery fire directed on the bridge site, and if smoke is used to cover the crossing, the guns close to the river will be useless as far as AA protection is concerned.

(3) To give the widest possible sectors of fire.

(4) To give greatest camouflage possibilities consistent with fire missions.

(5) Place machine-gun squads closest to the crossing point and automatic weapons squads farther out except as indicated in (6) below.

(6) When bridge is under construction and use, locate an automatic weapons squad at each end of the bridge to protect against dive bombing attack. (See ch. 2.)

e. Conduct of the attack.—(1) The AA squads move rapidly and quietly into position, remain alert and ready to fire.

(2) After the ferry is constructed and some tank destroyer units have crossed, designated AA units are ferried across and move rapidly to tentatively selected positions. Platoon and battery commanders inspect positions and make necessary adjustments.

(3) Those units moving to the enemy bank of the river must be prepared to assist in repelling mechanized attack. If AA firing positions are not satisfactory for this purpose, select alternative positions from which effective fire can be delivered.

(4) When the bulk of the division has crossed, some AA units may be withdrawn from the bridge site and sent to join combat units. Readjustment of firing positions for units remaining at the bridge is made as necessary.

■ 44. DEFENSE OF A RIVER LINE.—*a.* As part of a larger unit the armored division is used as a counterattacking unit in

defense of a river line. Operation of the AA battalion is similar to that of attack (ch. 5).

b. When the armored division defends a river line alone it operates as described in FM 17–100. The AA battalion is employed to—

(1) Defend bridges and fords that are being held for return of reconnaissance and counterreconnaissance elements on the enemy bank of the river.

(2) Protect reserves.

(3) Protect trains.

(4) Operate as in the attack when reserves counterattack. (See ch. 5.)

c. When all friendly troops have returned from the enemy bank of the river *and the bridge is destroyed* defending AA units are withdrawn to protect troops or installations.

d. If a ford is being protected, AA elements must remain to assist defending troops even though the ford may be demolished.

■ 45. DESERT OPERATIONS.—*a.* FM 31–25 covers desert operations. FM 17–100 gives formations for the armored divisions for desert warfare.

b. The formations taken in the desert will be wide and deep with 100 to 300 yards between vehicles. The huge dust clouds raised by track laying vehicles will interfere with AA fire unless such vehicles march well to the flanks. Figure 68 shows one method of using AA units.

c. FM 17–100 shows one type of bivouac in the desert. AA units should be used on the perimeter of this bivouac to protect against aircraft and mechanized attack.

FIGURE 66.—AA protection of a river crossing.

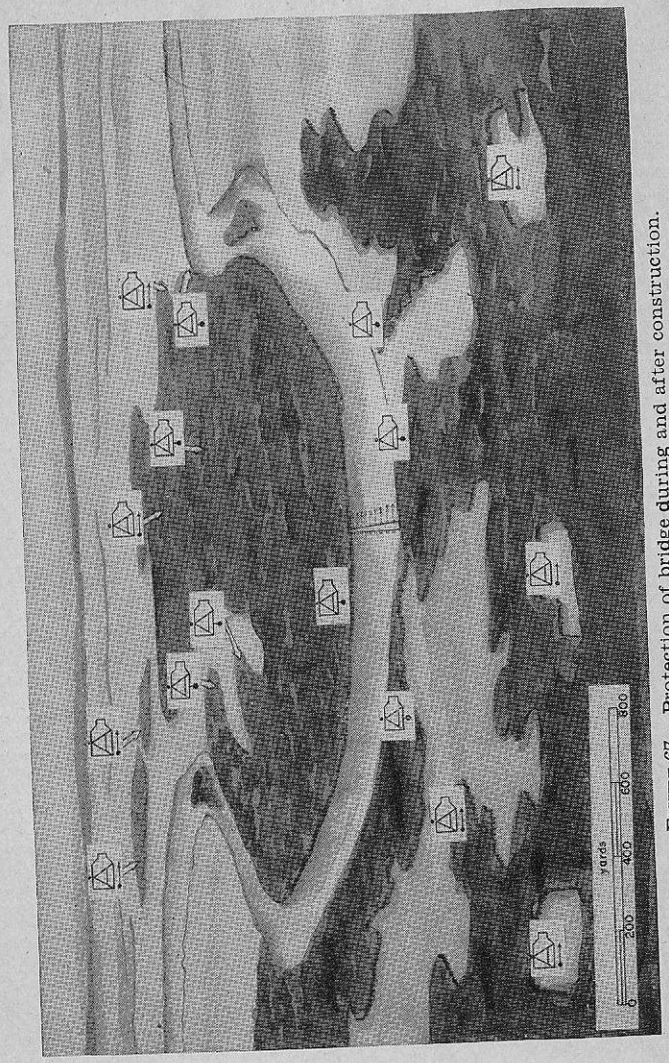

FIGURE 67.—Protection of bridge during and after construction.

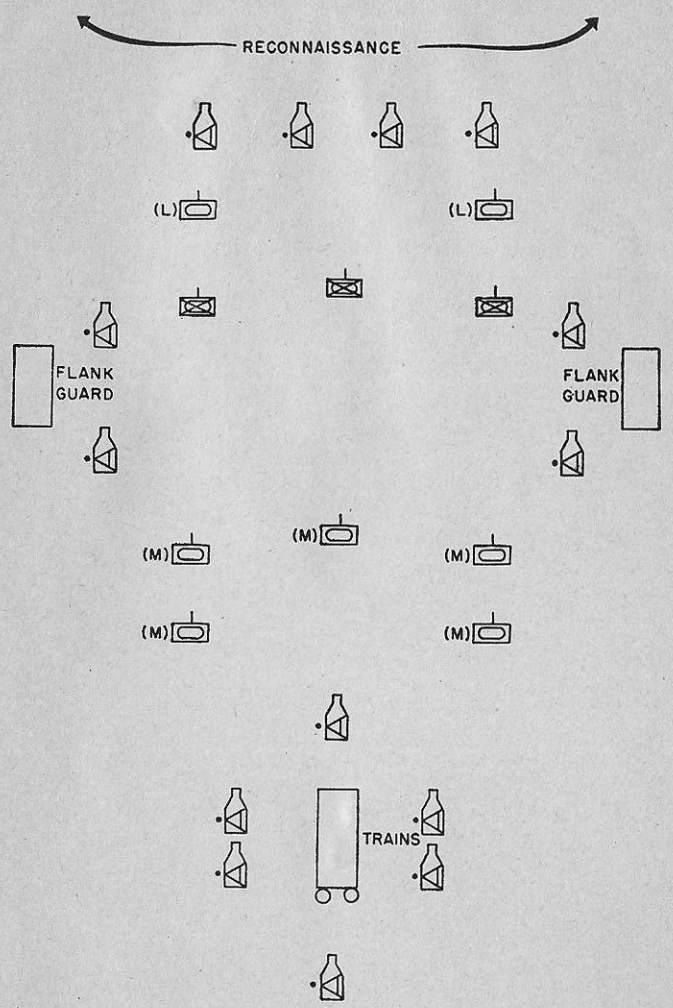

FIGURE 68.—One method of protecting a combat command in the desert.

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